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A CRITICALLY ANNOTATED BIBLIOGRAPHY OF THE LITERATURE ON HUMAN --ETC(U)

MAY 78 H R RAMSEY, M E ATWOOD, P J KIRSHBAUM N00014-76-C-0866

SAI-78-070-DEN

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# A CRITICALLY ANNOTATED BIBLIOGRAPHY OF THE LITERATURE OF HUMAN FACTORS IN COMPUTER SYSTEMS

By

H. Rudy Ramsey Michael E. Atwood Priscilla J. Kirshbaum

Science Applications, Inc. 7935 E. Prentice Ave. Englewood, CO 80110

31 May 1978



This work was supported by the Engineering Psychology Programs, Office of Naval Research under Contract N00014-76-C-0866, Work Unit Number NR196-146.



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Science Applications, Inc. 7935 East Prentice Avenue Englewood, Colorado 80110	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS  NR196-146
Office of Naval Research  800 North Quincy Street Arlington, Virginia 22217  14. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office)	13. May 1078  13. HOWSER OF PAGE.  390 10 399  18. SECURITY CLASS. (of this rough)
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human factors engineering, bibliographies, compute interfaces, interactions	ers, man machine systems,
20. ABSTRACT (Continue on reverse side it necessary and identity by block number)  A very broad survey of the literature dealing with systems was performed. Included in the survey were proceedings papers and institutional publications psychology, human factors, and computer science.	re books, journal articles, from the literatures of From the resulting list,
564 references were selected for inclusion in this	392878

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The references selected deal primarily with the human factors aspects of interactive computer systems, including hardware, software and procedures. The selection of references emphasizes experimental studies, but the bibliography also includes relevant descriptions of dialogue techniques, user requirements analysis methods, guidelines, and a variety of other relevant topics.

\*\*Provided Jincluding\*\* \* to getter with

For each reference, a citation is presented with sufficient information to allow the reader to obtain a copy, for each reference, both a descriptive abstract and a critical annotation are presented. An extensive subject index, as well as an author index and browsing aids, allow the users to locate those articles in which they are interested.

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# INTRODUCTION

This bibliography is one of the products of a rather broad survey of the literature on human factors in computer systems. The survey was conducted under research contract NO0014-76-C-0866, funded by the Engineering Psychology Programs Division of the Office of Naval Research. It is hoped that the bibliography will provide a useful, descriptive, and critical guide to the literature for at least three classes of users: (a) applied human factors personnel working in the area of computer applications, (b) basic and applied behavioral researchers interested in people-computer systems, and (c) computer system designers.

### THE PROBLEM

Human factors in computer systems is by nature a highly interdisciplinary field. As a result, the relevant literature is widely
scattered. Those who would perform effective application work in this
area must be aware of a broad range of literature, including: (a) the
general literature on human factors, as well as that concerned specifically
with computer systems, displays, data entry, and specific application
areas; (b) a significant segment of the basic psychological literature,
including especially the areas of perception, information processing,
and cognitive psychology; and (c) a significant segment of the computer
science literature, including especially the areas of batch and interactive
languages, display and input devices and techniques, and specific application areas. If the maintenance of such a broad familiarity with the
literature is difficult, initial familiarization by the new professional
is even more difficult. Very few academic curricula deal with these
diverse information sources to a significant degree.

A similar problem greets the worker who would perform basic psychological research, or even applied human factors research, in the area

of people-computer interaction. Considering the history of applied psychological research, it is clear that such research typically lags the development of the corresponding technology to a significant degree. In recent years, however, human factors problems have become a more dominant issue in the development of successful people-machine systems. One result has been a sharp reduction in the research lag. Thus, modern psychological researchers who wish their results to be useful in the development of a technological area can no longer afford to rely on secondary sources for an understanding of that area. To a greater degree than in the past, the researcher must attend to the primary literature of the technological area in which the researcher is interested. The behavioral research lag, coupled with a strong need for relevant empirical data, has also encouraged computer scientists to undertake behavioral studies of their own. Thus, even if one wishes only to keep abreast of behavioral research pertaining to computer systems, one must still attend to all three areas of literature. Unfortunately, the body of behavioral studies reported in the psychological literature and those reported in the computer science literature have developed somewhat independently, with the result that neither has benefitted from the level of cross-fertilization which might have attended a more closely integrated literature.

The conscientious computer system designer is in an even more difficult position. Although the designer may recognize that many design problems have human factors overtones, he or she has typically had little or no exposure to the psychological or human factors research literature. In well established research areas (e.g., keyboards, certain aspects of display design), human factors handbooks may help considerably. For a broader perspective, however, or to assist in the solution of many specific design problems, the designer would benefit from an ability to locate the specifically relevant papers in the research literature.

# THE SUBJECT MATTER OF THE SURVEY

Because the authors believe that these needs exist, and because no recent or comprehensive literature survey appears to have been done in this area, we have undertaken a fairly comprehensive survey of the literature relevant to human factors in computer systems. The short-term goals of the project were to produce a descriptive and critical bibliography of the individual papers in the field, and to produce an integrative and critical summary of the current state of the art in the field. The latter report has been published separately as Technical Report SAI-78-071-DEN. Aside from their potential value in their own right, these two reports were also intended to allow an evaluation of the feasibility of a longer-term goal, the development of an extensive human factors guide to computer system design.

Obviously, it was necessary to place some bounds on the subject matter, in order to allow a manageable survey effort. In its broadest sense, the field of human factors in computer systems is concerned with virtually every aspect of computer system design and use, including hardware, software, batch and interactive languages and dialogue methods, environment and procedures for use, personnel selection, training, and management, system evaluation, documentation, and the organizational and societal implications of computer use. It is concerned with determining both the common and the unique properties of various classes of computer system users (including computer operators and programmers, as well as application system users), and of the various types of tasks for which people use computers. The field is concerned with both batch and interactive systems, and therefore with both batch and interactive input and output devices and their use. Many aspects of software development are of concern to the field, because software development warrants human factors attention in its own right, and because the success of the software development effort often affects the specific system capabilities available to the end user and the user's mode of interaction with the system. To the (considerable) extent that computer systems are used to assist humans in the acquisition, integration, and communication of information, and in decision making and problem solving, the field is concerned with human perceptual, cognitive, and communicative behavior. To the extent that computers are made to emulate human behavior in order to interact more successfully with humans, as by emulating natural-language communication, the field must concern itself with at least the functional attributes of artificial intelligence systems. It's a broad field.

We have restricted our survey, for the most part, to those segments of the literature which are of the most concern in the design and use of interactive application systems. Thus, the survey <u>includes</u> such areas as interactive input and output devices and techniques (and, to a limited extent, batch output devices and techniques, as well), people-computer dialogue (including languages and dialogue methods), analysis of user and task properties, techniques for user requirements analysis, system design, and people-computer system modeling and evaluation, and people-computer problem solving. The survey <u>excludes</u> such areas as personnel selection, training, and management, documentation, social and organization implications of computers, software development and literature describing specific systems.

While the survey boundaries just cited seem clear in principle, they are rather fuzzy in practice. Articles on computer-assisted instruction do not generally fall within the scope of the survey, but some of those articles concern human factors considerations in CAI which are similar to those in non-CAI systems. Others concern CAI as a mechanism for training the user of a computerized non-CAI system (i.e., "embedded training"). Articles such as these are relevant to the survey. Most articles on software development are outside the scope of the survey, but some articles on interactive programming and debugging contain data or discussions which may be relevant to nonprogramming applications. Articles

describing specific systems are generally excluded from the survey, but those describing human-factors-related problems encountered and methods employed in the system development process may be relevant, even though the discussion occurs in the context of a system description. We have found the decisions to include or exclude a particular article to be frequently subjective and sometimes quite difficult.

Another issue which bears on the relevance of individual articles is the orientation of those articles. Clearly, articles are relevant which report empirical studies of behavioral factors that affect people-computer interaction. On the other hand, we believe that to restrict our concern purely to such research literature would defeat our purposes, for two reasons. First, a number of the articles which we feel are relevant are themselves attempts to summarize, integrate, criticize and/or interpret the research findings relevant to people-computer interaction. These articles are important contributions to the field, and are often more readable and more directly applicable to the work of system design than are the original research papers.

Secondly, and perhaps more controversially, we have attempted to include a limited number of papers which discuss current practices in people-computer interaction. It is a basic fact of human factors research that it is almost always performed in response to, rather than in anticipation of, an applied problem. Thus, there is always a "research lag", in which current applied practices exist which may or may not be behaviorally sound, on which little or no empirical study has been done, and which may be good candidates for productive behavioral research. In a field developing as rapidly as this, it would be foolish for any of us to ignore the ideas and inventions of others, either because they are called "research", or because they are not. Some of the papers we have surveyed on such topics as natural-language understanding and graphical input techniques contain excellent discussions of the human factors issues involved. In our opinion, these articles cannot be ignored without

slighting someone. The behavioral researcher may find his next research topic there. The system designer can benefit from the ideas therein and from a critical evaluation of those ideas from a human factors viewpoint. Moreover, if an ultimate goal is the development of a human factors guide to computer system design, we must ensure that the literature surveyed is sufficiently current to make the guide useful to the system designer, or the guide will go unused.

Within the scope of our literature survey, there are a number of areas in which a well established specialty literature exists. Some examples are keyboard design, color coding, and automated speech understanding. In such cases, we have attempted to include major survey articles, and articles especially relevant to computer systems design. In these areas, we have not attempted to survey exhaustively the original research literature, much of which is not computer-system specific.

In summary, we have attempted to survey a field of literature which is sufficiently large to ensure that the resulting bibliography, survey report, and potential design guide are broadly useful. At the same time, we have been acutely aware that a very large body of literature falls within or near the boundaries we have selected. In conducting the survey, we have considered something in excess of 20,000 citations, actually listed over 4000 in our data base, and selected 564 which we feel to be the most relevant and/or representative papers in the field. Because of the large volume of literature with which we have dealt, and perhaps our own preconceptions and fallibility, we have undoubtedly omitted papers which are relevant to the topic of our survey. If we have done so, we ask that such omissions be: (a) forgiven, if possible, and (b) pointed out to us for rectification in the future.

# THE LITERATURE SEARCH STRATEGY

In order to convey to the reader an understanding of the scope of the survey in terms of information sources, the literature search strategy which was employed will be described briefly. The project began with the personal bibliography collected by the first author and similar bibliographies which had been developed by several colleagues kind enough to contribute them to the effort. In order to expand the coverage of the public journals, the most relevant journals and proceedings were scanned as exhaustively as possible for relevant articles. Examples of such sources include:

AFIPS Conference Proceedings
Annual Review of Information Science and Technology
Communications of the ACM
Ergonomics
Human Factors
IEEE Transactions on Man-Machine Systems
International Journal of Man-Machine Studies
IRE Transactions on Human Factors in Electronics
Proceedings of the Annual Man-Computer Communication Seminar (Canada)
Proceedings of the Human Factors Society.

A large number of additional journals and proceedings, both foreign and domestic, were scanned for the most recent several years (usually about 1970 to date). In an effort to locate relevant papers not published in public journals (especially those produced by government agencies and their contractors), literature searches were performed through the Defense Documentation Center and the National Technical Information Service.

Several abstracting publications, and abstracting services of journals, were consulted. In particular, <a href="Ergonomics Abstracts">Ergonomics Abstracts</a> was scanned exhaustively. A number of existing published bibliographies dealing with human factors or computer systems literature were consulted. Announcements of the project, and solicitations of information concerning relevant papers, were published in a special interest newsletter and were also sent directly to individuals known to be active in the field (e.g., participants in the

NATO Advanced Study Institute on Man-Computer Interaction held in Greece in 1976). Finally, the reference lists of documents determined to be relevant were scanned for relevant secondary references. The result has been a fairly exhaustive survey, which has captured a large portion of the existing literature in the field.

# THE CONTENT AND FORMAT OF THE BIBLIOGRAPHY

The bibliography is composed of three principal sections: (1) the introduction; (2) the body of the bibliography, including citations, abstracts, and critical annotations of the articles reviewed; and (3) indexes to the articles by author and subject.

The main purpose of the introductory section is to describe the bibliography and its use. The format and contents of the bibliographic entries will be explained in detail and the reader will be introduced to the nature and use of the bibliographic indexes.

# Bibliographic Entries

Samples of bibliographic entries are shown in Figures 1, 2, and 3. Each entry consists of five basic elements. The first element is the document number. Each document is assigned a unique number corresponding to its alphabetic position in the bibliography. The indexes will refer to documents by this number. This reduces the size of the indexes and should allow the reader to quickly locate any desired entry. The second element describes the principal topic of the document. These descriptions, which do not necessarily correspond to entries in the subject index, are intended to allow the reader to easily determine the primary subject matter of a given document in order to facilitate browsing through the

O<sub>154</sub> INFORMATION STRUCTURES Durding, B.M., BECKER, C.A., & GOULD, J.D. PATA ORGANIZATION. SRESEARCH REPORT RC-4956). GORKTOWN HEIGHTS, NEW YORK: TIBM WATSON RESEARCH CENTER, BULY 1974. ODESCRIPTION:

THREE EXPERIMENTS INVESTIGATED HOW PEOPLE ORGANIZE DATA. SUBJECTS WERE GIVEN SETS OF 15-20 WORDS AND ASKED TO ORGANIZE THEM. EACH WORD SET HAD A PRE-DEFINED ORGANIZATION (HIERARCHY, NETWORK, LISTS, TABLE, RANDOM) BASED ON THE SEMANTIC RELATIONS AMONG THE WORDS. EXPERIMENT 1 SHOWED THAT COLLEGE STUDENTS HAVE THESE ORGANIZATION STRUCTURES AVAILABLE FOR USE. THEY ORGANIZED MOST WORD SETS ON THE BASIS OF THE SEMANTIC RELATIONS INHERENT IN THE DATA. WHEREAS MOST SUBJECTS USED "APPROPRIATE" ORGANIZATIONS (THOSE THAT MOST EASILY PRESERVED THE RELATIONS), A FEW SUBJECTS ORGANIZED NEARLY ALL WORD SETS INTO LISTS. EXPERIMENT 2 SHOWED THAT SUBJECTS CAN EFFICIENTLY FIT THE WORD SETS INTO "SKELETONS" THAT WERE EXPLICITLY DESIGNED TO MAINTAIN ALL THE SEMANTIC RELATIONS AMONG THE WORDS. EXPERIMENT 3 SHOWED THAT SUBJECTS MAVE DIFFICULTY IN PRESERVING THE RELATIONS AMONG DATA WHEN THEY WERE REQUIRED TO ORGANIZE THE DATA INTO INAPPROPRIATE STRUCTURES. THESE RESULTS ARE EVALUATED RELATIVE TO THE USE OF COMPUTER-BASED INFORMATION RETRIEVAL SYSTEMS. (A)

1040P, 1217R.

GCOMMENTS:

THIS IS A NOVEL AND INTERESTING SERIES OF EXPERIMENTS. BASICALLY, THE EXPERIMENTS DEMONSTRATED THAT DIFFERENT LOGICAL INFORMATION STRUCTURES (AS DISTINGUISHED FROM PHYSICAL FILE STRUCTURES) ARE APPROPRIATE FOR DIFFERENT SITUATIONS, AND THAT AN ATTEMPT TO FORCE THE USER OF A DATA BASE TO USE AN INAPPROPRIATE INFORMATION STRUCTURE WILL RESULT IN A DEGRADATION OF PERFORMANCE. THE SUBJECTS' TASK WAS RATHER ABSTRACT, BUT THE RESULTS ARE BELIEVABLE AND PROBABLY APPLY SIMILARLY TO "REAL-WORLD" TASKS INVOLVING DATA ENTRY AND USE OF A STRUCTURED DATA BASE. AS IS OFTEN THE CASE, THE STUDY RAISES MORE QUESTIONS THAN IT ANSWERS. WHILE IT MAKES US AWARE THAT LOGICAL INFORMATION STRUCTURE IS A RELEVANT FACTOR IN MAN-COMPUTER COMMUNICATION. AND THAT COMPUTER SYSTEM USERS CAN BE EXPECTED TO BE ABLE TO USE SEVERAL SUCH STRUCTURES (SOME MORE SATISFACTORILY THAN OTHERS), IT DOES NOT ADDRESS THE MORE COMPLICATED ISSUE OF DETERMINING THE APPROPRIATE STRUCTURE FOR A SPECIFIC SITUATION. IT MAY, THEREFORE, LEAVE THE APPLICATION-ORIENTED READER SOMEWHAT COLD. IT IS, HOWEVER, A GOOD PIECE OF BASIC RESEARCH, AND ITS EXPERIMENTAL METHOD MAY VERY WELL HELP ANSWER THESE MORE APPLIED QUESTIONS. THIS APPEARS TO BE A POTENTIALLY PRODUCTIVE LINE OF RESEARCH.

- 1. Document number
- Subject heading
- 3. Author(s)
- 4. Report title
- Report number
- Place of publication 6.
- Publishing institution
- 8. Date of publication
- 9. Abstract
- 10. Source of abstract
- 11. Total number of pages
- 12. Total number of references
- 13. Annotation

Figure 1. Sample bibliographic entry for a technical report

COMPUTER-AIDED ARCHITECTURAL DESIGN BAZJANAC, V. OTHE PROMISES AND THE DISAPPOINTMENTS OF COMPUTER-AIDED DESIGN. IN N. NEGROPONTE (ED.), PREFLECTIONS ON COMPUTER AIDS TO DESIGN AND ARCHITECTURE.

DESCRIPTION:

THE PRINCIPAL REASONS FOR SIGNIFICANT INTEREST IN COMPUTER-AIDED DESIGN IN ARCHITECTURE ARE THE PROMISES THAT THIS CONCEPT IMPLIES. THESE PROMISES ARE THAT SUCH AIDS WILL FREE THE DESIGNER FROM DISTRACTING AND UNPRODUCTIVE ACTIVITIES AND ALLOW HIM TO DEVOTE MORE TIME TO DESIGN, THAT THE DESIGNER WILL BE ABLE TO PREDICT PERFORMANCE OF ANY DESIGN ALTERNATIVE HE MAY GENERATE, AND THAT ACCUMULATED EXPERIENCES WILL BE INSTANTANEOUSLY AVAILABLE. THE LACK OF SUCCESS OF COMPUTER-AIDED DESIGN IS DUE TO MISCONCEPTIONS ABOUT HOW DESIGN IS ACTUALLY DONE; PRINCIPALLY THAT FORMAL MODELS OF THE DESIGN PROCESS CAN BE EXTRACTED. IT IS ARGUED THAT DESIGN AIDS INCREASE, RATHER THAN REDUCE, RESOURCE DEMANDS ON THE DESIGNER AND THAT ADDING RESOURCES WILL NOT IMPROVE THE QUALITY OF DESIGNS. (MEA)

10P, 13 OR.

COMMENTS:

THE AUTHOR OF THIS PAPER EXPRESSES CONSIDERABLE DISAPPOINTMENT WITH WHAT HAS BEEN ACHIEVED IN THE AREA OF COMPUTER-AIDED ARCHITECTURAL DESIGN AND DRAWS THE HIGHLY PESSIMISTIC CONCLUSION THAT SIGNIFICANT ACCOMPLISHMENTS IN THIS AREA ARE IMPOSSIBLE IN PRINCIPLE. AS HE POINTS OUT, MANY PAST EFFORTS HAVE BEEN CHARACTERIZED BY A LACK OF ATTENTION TO THE NATURE OF THE DESIGN PROCESS ITSELF. THE EXAMPLES CITED IN THE PAPER SEEM TO JUSTIFY AT LEAST THE CONCLUSION THAT SOME ASPECTS OF THE DESIGN PROCESS ARE INAPPROPRIATE FOR AUTOMATED AIDS (E.G., AUTOMATION OF THE BENAVIOR OF A HIGHLY COMPETENT. EXPERIENCED COST ESTIMATOR). WHETHER OR NOT THE AUTHOR'S MORE GLOBAL PESSIMISM IS JUSTIFIED IS ARGUABLE. IN ANY EVENT, THE PAPER POINTS OUT A NUMBER OF STUMBLING BLOCKS WHICH HAVE BEEN ENCOUNTERED IN COMPUTER-AIDED DESIGN, AND IT SHOULD BE OF INTEREST TO THE AUTOMATED-DECISION-AID COMMUNITY AS A WHOLE.

- Document number
- Subject heading 3. Author(s)
- Chapter title
- Author(s) or editor(s) of the entire book
- 6. Designation of editor(s)
- 7. Book title
- Place of publication

- 9. Publishing institution
- 10. Date of publication
- 11. Chapter pages
- 12. Abstract
- Source of abstract 13.
- 14. Total number of pages
- Total number of references 15.
- Annotation 16.

Figure 2. Sample bibliographic entry for a book chapter

Other Coding Color Coding Research for Visual Displays. Shuman factors, \$\overline{O}\_{1975}\$, \$\overline{O}\_{17}\$, \$\overline{O}\_{542-570}\$.

DESCRIPTION:

THE EXPERIMENTAL LITERATURE ON THE EFFECTS OF COLOR ON VISUAL SEARCH AND IDENTIFICATION PERFORMANCE WAS REVIEWED. FORTY-TWO STUDIES PUBLISHED BETWEEN 1952 AND 1973 WERE LOCATED THAT GAVE RESULTS WHICH COULD BE USED TO DETERMINE THE EFFECTIVENESS OF COLOR CODES RELATIVE TO VARIOUS TYPES OF ACHROMATIC CODES. QUANTITATIVE ANALYSES OF THESE RESULTS INDICATED THAT COLOR MAY BE A VERY EFFECTIVE PERFORMANCE FACTOR UNDER SOME CONDITIONS, BUT THAT IT CAN BE DETRIMENTAL UNDER OTHERS. TENTATIVE CONCLUSIONS ABOUT THE NATURE OF THESE CONDITIONS WERE DERIVED FROM THE RESULTS. A GUIDE FOR DESIGN DECISIONS AND AN INDICATION OF KNOWLEDGE GAPS ARE ALSO PROVIDED.

12 29P, 13164R.

COMMENTS:

THIS EXCELLENT PAPER PRESENTS A THOROUGH AND UP-TO-DATE REVIEW OF THE LITERATURE ON THE EFFECTS OF COLOR CODING IN VISUAL DISPLAYS AND ALSO PRESENTS A CONCISE AND CLEAR SUMMARY OF THE PRINCIPAL RESULTS OF THESE STUDIES. THIS PROVIDES A GOOD REFERENCE DOCUMENT ON THE USE OF COLOR CODING IN VISUAL DISPLAYS. BASED ON A REVIEW OF 42 EXPERIMENTAL STUDIES, REDUNDANT, PARTIALLY REDUNDANT, AND NONREDUNDANT COLOR CODING WERE FOUND TO IMPROVE PERFORMANCE IN SEARCH TASKS WITH HIGH CONSISTENCY. MAGNITUDE OF IMPROVEMENT VARIES WITH THE ALTERNATIVE CODING TECHNIQUES WITH WHICH COLOR CODING WAS COMPARED AND THE WAY IN WHICH COLOR CODING WAS EMPLOYED. RESULTS IN IDENTIFICATION TASKS WERE LESS CONSISTENT. COLOR CODING SOMETIMES HELPED, SOMETIMES HINDERED PERFORMANCE HERE. AGAIN, THOUGH, THERE ARE SOMEWHAT CONSISTENT RELATIONSHIPS BETWEEN THE EFFECTS OF COLOR CODING AND THE WAY IN WHICH IT IS USED. THE AUTHOR ALSO INDICATES AREAS IN WHICH ADDITIONAL RESEARCH IS NEEDED AND PRESENTS A BIBLIOGRAPHY OF LITERATURE PERTAINING TO THE USE OF COLOR IN DISPLAYS. THIS PAPER IS FAIRLY DETAILED, AND MAY CONTAIN MORE INFORMATION

THAN SOME READERS WAN'S TO ABSORB. ON THE OTHER HAND, IT IS THE OUTSTANDING PAPER ON COLOR CODING, AND SHOULD BE USEFUL TO RESEARCHERS AND PRACTITIONERS

- 1. Document number
- 2. Subject heading
- 3. Author(s)
- 4. Article title
- 5. Primary publication title

ALIKE.

- Year of publication (month cited in parentheses if each issue starts with p.1)
- Volume number (issue number cited in parentheses if each issue starts with p.1)
- 8. Inclusive pagination (when discontinuous, separated by semicolons)
- If present, NTIS accession number for same or similar article published as a technical paper
- 10. Abstract
- 11. Source of abstract
- 12. Total number of pages
- 13. Total number of references
- 14. Annotation

Figure 3. Sample bibliographic entry for a journal article

bibliography. The remaining elements of each bibliographic entry, the citation, abstract, and annotation, are described in the sections below.

# Citations

The basic format for citations has been adopted from the Publication Manual of the American Psychological Association (Second Edition). As can be seen in Figures 1, 2, and 3, the exact form of the citation depends on the type of document being cited. These figures describe, respectively, a technical report published by an institution, a book chapter, and a journal article.

In some cases, a document has been published in several forms. For example, a paper appearing originally in the proceedings of a conference will later be published in a journal, or a journal or proceedings paper will later be redistributed by an agency. In these cases, we have modified the citation format to identify the multiple sources through which the document is available and provide sufficient information for the reader to obtain the document.

# Abstracts

Abstracts, which are identified in the bibliographic entries as "Descriptions", provide brief descriptions of the content of the referenced document. In those cases where the author of a paper has prepared an abstract, we have used the author's abstract when it conveys information about the article that is relevant to the scope and purposes of this bibliography and when it accurately describes the content of the article. In those cases where these conditions were not satisfied, or where no author abstract was provided, an abstract was prepared by the authors of

this bibliography. Each abstract identifies the source of the abstract and indicates the total numbers of pages and references included in the document. If the indicated abstract source is "A", the abstract was derived from the paper itself, and is attributed to the author. Abstracts which appear to have been written by others, such as the editor of the journal in which the paper appeared, are indicated by "O". If no source indication is given, the abstract was prepared by one of the authors of this bibliography.

# Annotations

While an abstract is intended to be descriptive, an annotation provides a critical commentary on the content of a document. An annotation is intended to aid the reader in evaluating a document in terms of its overall quality and limitations. The annotations are intended to be responsive to the basic content of each article. Where the articles are primarily concerned with describing empirical research, we have commented on the appropriateness of the experimental methodology and the validity and generality of the reported results. For review papers, we have commented on the scope and quality of the review. For those articles that offer suggestions or guidelines for the design or evaluation of people-computer systems, we have attempted to comment on the feasibility and usefulness of these suggestions or guidelines and to evaluate them with respect to the information presented in other articles. These evaluations are necessarily subjective, and represent our (hopefully informed) opinions. Our criticisms are intended to be constructive, and we hope that they will taken in that spirit.

# Abbreviations

A small number of abbreviations have been used in the bibliography. These are shown below:

abbreviated abbr. Air Force Base (as in Wright-Patterson AFB) AFB edition ed. revised edition rev.ed. second edition 2nd ed. Ed.(Eds.) Editor(s) p. (pp.) pages(s) Vol. volume (as in Vol. 1) vols. volumes (as in 4 vols.) Number No. Part Pt. Corporation (as in Rand Corp.) Corp. Incorporated (as in Bolt Beranek and Newman, Inc.) Inc.

# Indexes

There are two indexes in the bibliography: (1) author and (2) subject. These indexes are located at the back of the bibliography in the order in which they are listed above. Their content and function are discussed in the following sections.

# Author Index

The author index indicates, by document number, all articles of which a particular individual is an author. This allows articles by an author to be located, even though he may not be the first author.

# Subject Index

The subject index indicates, by document number, articles which deal with a particular subject to a significant degree. This index has a rather unusual structure, intended to assist the user in finding related subject categories, and thus, related papers. The index is highly hierarchic, with related topics listed together as much as possible. An example is shown in Figure 4. This figure illustrates both the hierarchic structure of the index and its use of cross-pointers to aid the user in determining the particular vocabulary we have chosen to use in the index. In the figure, the reader is directed to another area of the index if he is interested in dialogue control.

Note that the subject categories which are most specific occur at the lowest levels of the hierarchy, and that pointers to specific articles may occur at any level of the hierarchy. For example, paper 4 apparently contains a fairly general discussion of man-computer dialogue. Paper 514 is concerned specifically with the type of man-computer dialogue in which the user is browsing through a data base. Paper 137 is concerned with menu-selection dialogues in general, while papers 251 and 25 are concerned with menu-selection dialogues as used for specific purposes.

It is our belief that this index structure will assist the user both in finding the level of specificity needed and in becoming aware of related topics which might otherwise have been overlooked. Because of its structure, the subject index is something like a taxonomy of the field. The reader might even find it worthwhile to browse through the index, as it conveys a view of the structure of the field and a better understanding of the subject area of the bibliography itself.

Because of the hierarchic structure of the index, the reader may find it helpful to enter the index first by a relatively global term even if he is interested in a fairly specific topic. In Figure 4, for example, the reader

```
DIALOGUE
   CONTROL -- SEE DIALUGUE, MAN-COMPUTER, SPECIFICATION AND CONTROL TECHNIQUES
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Figure 4. Sample section of subject index

can easily locate articles on graphical hand-drawing input without knowing the terminology we have used for such input, by starting at DIALOGUE and working his way down.

1 MANAGEMENT INFORMATION SYSTEMS
ACKOFF, R.L. MANAGEMENT MISINFORMATION SYSTEMS. MANAGEMENT SCIENCE, 1967, 14, 147-156.

DESCRIPTION:

FIVE ASSUMPTIONS COMMONLY MADE BY DESIGNERS OF MANAGEMENT INFORMATION SYSTEMS ARE IDENTIFIED. IT IS ARGUED THAT THESE ARE NOT JUSTIFIED IN MANY (IF NOT MOST) CASES AND HENCE LEAD TO MAJOR DEFICIENCIES IN THE RESULTING SYSTEMS. THESE ASSUMPTIONS ARE: (1) THE CRITICAL DEFICIENCY UNDER WHICH MOST MANAGERS OPERATE IS THE LACK OF RELEVANT INFORMATION, (2) THE MANAGER NEEDS THE INFORMATION HE WANTS, (3) IF A MANAGER HAS THE INFORMATION HE NEEDS HIS DECISION MAKING WILL IMPROVE, (4) BETTER COMMUNICATION BETWEEN MANAGERS IMPROVES ORGANIZATIONAL PERFORMANCE, AND (5) A MANAGER DOES NOT HAVE TO UNDERSTAND HOW HIS INFORMATION SYSTEM WORKS, ONLY HOW TO USE IT. TO OVERCOME THESE ASSUMPTIONS AND THE DEFICIENCIES WHICH RESULT FROM THEM, A MANAGEMENT INFORMATION SYSTEM SHOULD BE EMBEDDED IN A MANAGEMENT CONTROL SYSTEM. A PROCEDURE FOR DESIGNING SUCH A SYSTEM IS PROPOSED AND AN EXAMPLE IS GIVEN OF THE TYPE OF CONTROL SYSTEM WHICH IT PRODUCES. (A) 10P, 1R.

COMMENTS:

THIS IS A GOOD, AND WIDELY KNOWN, PAPER ON THE CAUSES OF MANAGEMENT INFORMATION SYSTEM FAILURE. WHILE IT CONTAINS A FEW SUPPORTING ANECDOTES, IT CONSISTS PRIMARILY OF THE AUTHOR'S OPINIONS, AND IS BY NO MEANS A SCIENTIFIC TREATMENT. IT IS VERY INSIGHTFUL, HOWEVER, AND SHOULD SERVE TO HELP THE DESIGNER OF SUCH SYSTEMS AVOID A FEW PITFALLS. A MORE PRECISE AND UP-TO-DATE TREATMENT OF THIS SUBJECT IS EASON, K.D. (1976). THIS IS, HOWEVER, A GOOD INTRODUCTION TO THE SPECIAL PROBLEMS OF MIS DESIGN, WITH SOME RELEVANCE TO OTHER TYPES OF SYSTEMS.

2 TIME-SHARING VERSUS BATCH PROCESSING ADAMS, J., & COMEN, L. TIME-SHARING VS. INSTANT BATCH PROCESSING: AN EXPERIMENT IN PROGRAMMER TRAINING. COMPUTERS AND AUTOMATION, MARCH 1969, 18(3), 30-34. DESCRIPTION:

EIGHT STUDENT PROGRAMMERS STUDIED FORTRAN FOR TWO WEEKS, ONF WEEK USING A CRT-BASED TIME-SHARING SYSTEM AND ONE WEEK USING "INSTANT BATCH", IN A COUNTERBALANCED REPEATED-MEASURES DESIGN. BECAUSE OF LARGE INDIVIDUAL DIFFERENCES, NO SIGNIFICANT DIFFERENCES IN OBJECTIVE MEASURES WERE DETECTED. IN QUESTIONNAIRE RESULTS, HOWEVER, THE STUDENTS INDICATED A STRONG PREFERENCE FOR THE BATCH MODE. GIVEN A CHOICE, ALL STUDENTS USED THE BATCH SYSTEM FOR THE REMAINDER OF THE SUMMER.

COMMENTS:

A LACK OF SOPHISTICATION IN THE DESIGN AND STATISTICAL ANALYSIS OF THIS EXPERIMENT VIRTUALLY ASSURED THAT NO SIGNIFICANT OBJECTIVE PERFORMANCE DIFFERENCES WOULD BE FOUND. THE SMALL GROUPS OF PROGRAMMERS EMPLOYED (4 SUBJECTS EACH) WERE KNOWN TO CONTAIN WIDE VARIATIONS IN PRIOR EXPERIENCE (0-250 PROGRAMS WRITTEN), BUT NO EFFORT WAS MADE TO STATISTICALLY ISOLATE VARIATION DUE TO EXPERIENCE. YET EXPERIENCE MIGHT WELL ACCOUNT FOR MUCH OF THE VERY LARGE OBSERVED INDIVIDUAL DIFFERENCE VARIATION. FURTHERMORE, THOSE SUBJECTS WITH LITTLE PROGRAMMING EXPERIENCE WERE UNDOUBTEDLY LEARNING RAPIDLY, SO THAT AN INTERVENING FOUR DAYS OF PRACTICE BETWEEN TESTS FOR THE TWO CONDITIONS CAN BE EXPECTED TO HAVE INFLUENCED THEIR PERFORMANCE MORE THAN THAT OF THE EXPERIENCED PROGRAMMERS. UNFORTUNATELY, TOO, THE "TIME-SHARING VS. BATCH" COMPARISON IS ITSELF CLOUDED BY THE FACT THAT THESE CONDITIONS INVOLVED DIFFERENT COMPUTERS AND OPERATING SYSTEMS. WHETHER THERE WERE ALSO FORTRAN LANGUAGE DIFFERENCES IS NOT REPORTED. IT SEEMS LIKELY, THOUGH, THAT THE SUBJECTS, ESPECIALLY THOSE WITH EXTENSIVE PROGRAMMING EXPERIENCE, WERE ABLE TO OVERLOOK SYSTEM DIFFERENCES IN THEIR QUESTIONNAIRE RESPONSES, WHICH THE AUTHORS REPORT CONVINCINGLY. OVERALL, THE RESULTS OF THIS STUDY ARE NOT CLEARLY INTERPRETABLE, AND IT IS WORTHWHILE READING ONLY FOR THOSE WITH AN EXHAUSTIVE INTEREST IN THE TIME-SHARING VS. BATCH ISSUE.

3 SPOKEN MAN-COMPUTER DIALOGUE

ADDIS, T.R. HUMAN BEHAVIOUR IN AN INTERACTIVE ENVIRONMENT USING A SIMPLE SPOKEN WORD RECOGNIZER. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1972, 4, 255-284.

DESCRIPTION:

IN 1970 A TRIAL INTERACTIVE COMPUTER PROGRAM USING A SIMPLE WORD RECOGNIZER WAS DEMONSTRATED TO VISITORS AT THE PHYSICS EXHIBITION. THIS PROGRAM TOOK THE FORM OF A SPEECH-OPERATED TEACHING MACHINE WHERE THE VISITORS WERE INSTRUCTED BY THE MACHINE ON HOW TO USE IT.

INSTRUCTED BY THE MACHINE ON HOW TO USE IT.

THIS PAPER DESCRIBES A SIMPLE CONTEXTUAL MODEL (A PRIORI HEURISTICS) USED BY THE TEACHING PROGRAM. THIS MODEL WAS USED TO DETECT TWO TYPES OF BEHAVIOUR WHICH MODIFIED THE RESPONSE OF THE MACHINE. FROM ANALYSIS OF THE BEHAVIOUR OF 134 VISITORS WHO USED THE MACHINE, MODIFICATIONS TO THESE RULES ARE GIVEN (A POSTERIORI HEURISTICS). (A)

IN ADDITION TO DEVELOPING TECHNIQUES FOR DETECTING AND CORRECTING HUMAN BEHAVIOR THAT INTERFERES WITH EFFECTIVE MAN-COMPUTER INTERACTION, THIS PAPER ALSO CONSIDERS WHAT HUMAN ABILITIES ARE NECESSARY FOR SUCCESSFUL INTERACTION AND HOW TO MEASURE THESE ABILITIES AND OVERALL SYSTEM SUCCESS.

30P, 19R. COMMENTS:

THIS IS A HIGHLY EXPLORATORY STUDY IN WHICH THE AUTHOR ATTEMPTS TO SYSTEMATICALLY DESCRIBE THE BEHAVIOR OF NAIVE USERS OF A VERY SIMPLE MANCOMPUTER DIALOGUE UTILIZING A VERY LIMITED SPOKEN-WORD RECOGNIZER CAPABLE OF RECOGNIZING ONLY THE WORDS "YES", "NO", "WRONG", AND "STOP". THE AUTHOR'S ATTEMPT TO DERIVE A SET OF SIMPLE POSTULATES WHICH DESCRIBE USER BEHAVIOR IS LAUDABLE, BUT THE POSTULATES ACTUALLY DEVELOPED FAIL TO PROVIDE SIGNIFICANT INSIGHT AND ARE PROBABLY HIGHLY SITUATION-SPECIFIC. THE SPECULATIONS MADE CONCERNING THE BEHAVIOR OF ACTIVE VS. PASSIVE SUBJECTS ARE ALSO INTERESTING, BUT ARE TESTED ONLY IN A CIRCULAR MANNER, SINCE SUBJECT CLASSIFICATION IS DONE ON THE BASIS OF THOSE BEHAVIORAL CHARACTERISTICS RATHER THAN BY ANY INDEPENDENT MEANS. THE PAPER PROVIDES SEVERAL IDEAS WHICH MAY BE HELPFUL TO THOSE ATTEMPTING TO IMPLEMENT A DIALOGUE WITH AN EXTREMELY CONSTRAINED INPUT VOCABULARY, AND IT SHOULD, OF COURSE, BE READ BY THOSE ATTEMPTING TO IMPLEMENT AUTOMATED-SPEECH-RECOGNITION DIALOGUES.

A NATURAL-LANGUAGE DIALOGUE
ADDIS, T.R. MACHINE UNDERSTANDING OF NATURAL LANGUAGE. INTERNATIONAL JOURNAL
OF MAN-MACHINE STUDIES, 1977, 9, 207-222.
DESCRIPTION:

THE DEVELOPMENT OF MACHINE UNDERSTANDING OF NATURAL LANGUAGE IS BRIEFLY TRACED FROM THE EARLY YEARS OF MACHINE TRANSLATION TO TODAY'S QUESTION ANSWERING AND TRANSLATION SYSTEMS. THIS SURVEY OF SOME OF THE MODERN TECHNIQUES AND IDEAS SHOWS THEM, ALTHOUGH SUPERFICIALLY DIFFERENT TO BE FUNDAMENTALLY SIMILAR. (A)

THE COMMON PROCESSES SHARED BY MODERN LANGUAGE UNDERSTANDING SYSTEMS ARE: (1) THE USE OF MORPHEMES TO PROVIDE CLUES TO SYNTACTIC STRUCTURE, (2) THE DEPENDENCY OF WORD MEANING ON SENTENCE STRUCTURE, (3) THE GENERATION OF SEMANTIC STRUCTURE IN THE FORM OF GENERALIZED CLASSES AND RELATIONS, AND (4) THE OPERATIONS APPLIED TO THESE SEMANTIC STRUCTURES TO GENERATE DISCOURSE.

16P, 38R. COMMENTS:

THIS IS A CONCISE, EASY TO READ REVIEW OF THE HISTORY OF NATURAL LANGUAGE UNDERSTANDING SYSTEMS AND DISCUSSION OF THE CURRENT STATE OF THE ART OF SUCH SYSTEMS. THE AUTHOR ACCURATELY SUMMARIZES AND COMPARES SEVERAL SYSTEMS. THIS PAPER WOULD BE USEFUL TO ANYONE CONSIDERING THE DEVELOPMENT OR USE OF A NATURAL-LANGUAGE DIALOGUE SYSTEM.

5 MAN-COMPUTER DIALOGUE

ALBUS, J.S., EVANS, J.M., & JOHNSEN, E.G. A HIERARCHICAL CONCEPT FOR MAN-MACHINE COMMUNICATION. IN PROCEEDINGS OF THE 18TH ANNUAL MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1974, 506-509.

DESCRIPTION:

THE PROBLEM OF MAN CONTROLLING OR PROGRAMMING A MACHINE MAY BE CONSIDERED AS A HIERARCHY OF CONTROL FUNCTIONS, WITH EACH LEVEL OF CONTROL CALLING UP ORDERED SEQUENCES OF OPERATIONS AT THE NEXT LOWER LEVEL, USING APPROPRIATE SENSORY FEEDBACK FOR EACH LEVEL. MAN MAY ENTER THE CONTROL HIERARCHY AT ANY LEVEL FOR DIRECT CONTROL OR FOR PROGRAMMING AN AUTOMATIC SYSTEM FOR LATER PLAYBACK. THE COMPUTER CARRIES OUT LOWER LEVEL CONTROL FUNCTIONS, THEREBY AUGMENTING MAN'S CONTROL CAPABILITIES.

THE CEREBELLAR MODEL ARTICULATION CONTROLLER (CMAC) IS A COMPUTER BASED CONTROL SYSTEM IN WHICH HIGH-LEVEL TASK-ORIENTED COMMANDS CAN BE BROKEN DOWN INTO A SERIES OF ELEMENTAL MOTOR ACTUATOR SIGNALS. CMAC IS A GENERAL PURPOSE ADAPTIVE CONTROL CONCEPT WHICH CAN BE ARRANGED IN A HIERARCHICAL STRUCTURE, SUCH AS THAT DESCRIBED ABOVE, SO AS TO FACILITATE THE MAN-MACHINE COMMUNICATION PROBLEM. FOR EXAMPLE, CMAC CAN SOLVE THE COORDINATE TRANSFORMATION PROBLEM SO THAT COMMANDS CAN BE GIVEN IN TERMS OF DESIRED END POINT TRAJECTORIES. FURTHERMORE, CMAC CAN HANDLE MANY FEEDBACK VARIABLES SUCH AS MEASUREMENT OF MISALIGNMENT OF PARTS, VARIABLE MASS LOADING, IRREGULARITIES IN MATERIALS, AND CONSTRAINTS IMPOSED BY AN EXTERNAL ENVIRONMENT.

CONCEPTS OF MAN-MACHINE COMMUNICATION UNDER CONSIDERATION BY THE NATIONAL BUREAU OF STANDARDS AUTOMATION TECHNOLOGY PROGRAM ARE PRESENTED WITH PARTICULAR EMPHASIS ON THE CMAC CONTROL CONCEPT. (A) 4P, 4R.

COMMENTS:

THE MAN-MACHINE COMMUNICATION DISCUSSED IN THIS PAPER IS PRIMARILY CONCERNED WITH HOW MAN CAN CONTROL THE MACHINE'S ACTIONS RATHER THAN WITH HOW THE MACHINE CAN BEST COMMUNICATE INFORMATION TO THE MAN. THE CONCEPT OF EXPRESSING A COMPLEX TASK AS A HIERARCHY OF SIMPLER TASKS SEEMS USEFUL. THIS COULD, FOR EXAMPLE, ENABLE A MACHINE TO CARRY OUT THE ELEMENTAL TASKS NECESSARY TO PERFORM A COMPLEX TASK WHENEVER THAT COMPLEX TASK IS REQUESTED. ALTHOUGH THIS PAPER PRESENTS A REASONABLE DESCRIPTION OF A CONTROL SYSTEM TO OPERATE SUCH HIERARCHIES, IT LARGELY IGNORES THE QUESTION OF HOW THESE HIERARCHIES ARE INITIALLY FORMED.

THIS PAPER MAY BE RELEVANT TO THOSE CONCERNED WITH TECHNIQUES FOR HUMAN CONTROL OF MACHINE ACTIONS. A MORE THOROUGH DISCUSSION OF HOW COMPLEX TASKS CAN BE DECOMPOSED INTO A HIERARCHY OF SIMPLER TASKS IS PRESENTED IN E.D. SACERDOTI ("A STRUCTURE FOR PLANS AND BEHAVIOR", TECHNICAL NOTE 109, STANFORD RESEARCH INSTITUTE, 1975). THIS LATTER PAPER MAY BE ESPECIALLY RELEVANT TO THOSE INTERESTED IN ARTIFICIAL INTELLGENCE ASPECTS

6 KEYBOARDS, REVIEW ARTICLE
ALDEN, D.G., DANIELS, R.W., & KANARICK, A.F. KEYBOARD DESIGN AND OPERATION: A
REVIEW OF THE MAJOR ISSUES. HUMAN FACTORS, 1972, 14, 275-293 (A VERY SIMILAR
PAPER BY THE SAME AUTHORS IS TECHNICAL REPORT 12180-FR1A, HONEYWELL SYSTEMS AND
RESEARCH CENTER, ST. PAUL, MINNESOTA, MARCH 1970).
DESCRIPTION:

A SEARCH OF THE PSYCHOLOGICAL, TECHNICAL, AND PROMOTIONAL LITERATURE WAS CONDUCTED TO COMPILE INFORMATION RELEVANT TO KEY, KEYBOARD, AND OPERATOR CHARACTERISTICS. THE MOST RECENT AND SIGNIFICANT ARTICLES WERE DISCUSSED AND EVALUATED. WHERE POSSIBLE, GENERAL CONCLUSIONS HAVE BEEN DRAWN TO AID THE KEYBOARD DESIGNER. (A)

INCLUDED ARE DISCUSSIONS OF OPERATOR PHYSIOLOGICAL AND COGNITIVE CAPABILITIES AND LIMITATIONS; KEY DIMENSIONS, FORCE AND DISPLACEMENT; FEEDBACK AND INTERLOCKING; KEY LAYOUT AND GROUPING; AND KEYBOARD SIZE, SLOPE, AND TILT.
19P, 83R.

### COMMENTS:

THIS IS A GOOD, CAREFULLY WRITTEN REVIEW OF THE RESEARCH AND PROMOTIONAL LITERATURE ON KEYBOARD DESIGN AND USE. IT IS PRIMARILY DESCRIPTIVE, RATHER THAN PRESCRIPTIVE, ALTHOUGH IT DOES PRESENT SOME CONCLUSIONS AND THE LAST SECTION OF THE PAPER PRESENTS SEVERAL SPECIFIC RECOMMENDATIONS. THE AUTHORS POINT OUT A NUMBER OF AREAS IN WHICH MORE RESEARCH IS NEEDED. THEY ALSO POINT OUT THAT MUCH OF THE RELEVANT RESEARCH HAS BEEN DONE TO EVALUATE SPECIFIC PRODUCTS OR DESIGN ALTERNATIVES, RATHER THAN TO DETERMINE OPTIMAL PROPERTIES, DIMENSIONS, ETC. BECAUSE OF ITS READABILITY AND DESCRIPTIVE STYLE, THIS IS A GOOD ARTICLE FOR THOSE WHO WANT A QUICK SUMMARY OF THE ISSUES IN KEYBOARD DESIGN.

7 MAN-COMPUTER PROCESS CONTROL SIMULATION
ALFORD, E.C., & BUCK, J.R. A UNIT TASK SIMULATOR FOR OFF-LINE EVALUATION OF
MAN/COMPUTER INTERFACES. IN PROCEEDINGS, 6TH CONGRESS OF THE INTERNATIONAL
ERGONOMICS ASSOCIATION. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1976,
248-250.

### DESCRIPTION:

A METHOD IS SHOWN FOR SIMULATING INDIVIDUAL OPERATOR MAN/COMPUTER TASKS AND COLLECTING PERFORMANCE STATISTICS. THIS METHOD EMPLOYS A MINICOMPUTER WITH STRUCTURED SOFTWARE THAT RECEIVES USER-WRITTEN PROGRAMS FOR THE SPECIFIC PROCESSES AND FOR DISPLAY FORMATTING. USERS CAN EASILY TRY OUT AND EVALUATE ALTERNATIVE INTERFACE DESIGNS, DIFFERENT COMBINATIONS OF TASK ASSIGNMENTS, OR VARIOUS FORMATTING DIALOGUES. JOB AND TASK PERFORMANCE CHARACTERISTICS ARE DIRECTLY OBTAINED. AN ILLUSTRATION IS GIVEN. THESE PERFORMANCE CHARACTERISTICS MAY BE USED COMPARATIVELY OR AS INPUTS TO A TOTAL SYSTEM SIMULATION FOR THE DESIGN OF LARGE MAN/MACHINE SYSTEMS. (A) 3P, 6R.

### COMMENTS:

AS THE AUTHORS ASSERT, PURELY ANALYTICAL METHODS ARE SELDOM SUFFICIENT TO ANSWER QUESTIONS OF TASK ALLOCATION, MAN-MACHINE SYSTEM PERFORMANCE, AND DESIGN EVALUATION WHICH ARISE DURING THE DESIGN OF INTERACTIVE COMPUTER SYSTEMS. IN THESE SITUATIONS, MAM-IN-THE-LOOP SIMULATION IS CLEARLY THE METHOD OF CHOICE, BUT WITHOUT TOOLS WHICH SUPPORT SUCH SIMULATIONS. THEY ARE VERY EXPENSIVE AND TIME-CONSUMING TO DEVELOP. THE UNIT TASK SIMULATOR (UTS) DESCRIBED HERE IS A STEP IN THE RIGHT DIRECTION. IT CONSISTS PRIMARILY OF A SET OF FORTRAN SUBROUTINES WHICH CAN BE USED BY THE DESIGNER, IN ADDITION TO PROGRAMS WHICH HE MUST WRITE, TO CONTROL SUCH SIMULATIONS. THE CONCENTRATION OF UTS IS ON THE SIMULATION OF THE UNDERLYING PROCESS, RATHER THAN ON THE SIMULATION OF INTERACTIVE DIALOGUE. AS A RESULT, IT IS WELL ADAPTED TO PROCESS CONTROL SIMULATIONS WHICH MAY INVOLVE COMPLEX PROCESS MODELS, BUT WHICH ARE PROBABLY RESTRICTED TO RELATIVELY SIMPLE INTERACTIVE DIALOGUES. BECAUSE THE DESIGNER MUST WRITE HIS OWN DISPLAY FORMATING AND DIALOGUE-CONTROL SOFTWARE, AND BECAUSE FORTRAN IS A NOTABLY POOR LANGUAGE FOR DOING SO, UTS IS UNLIKELY TO SEE MUCH USE IN THE SIMULATION OF SOPHISTICATED MAN-COMPUTER DIALOGUES, AT LEAST IN ITS PRESENT FORM.

8 COMPUTER-AIDED ENGINEERING DESIGN
ALLAN, J.J., III. MAN-COMPUTER SYNERGISM FOR DECISION MAKING IN THE SYSTEM
DESIGN PROCESS (TECHNICAL REPORT 9). ANN ARBOR, MICHIGAN: UNIVERSITY OF
MICHIGAN, CONCOMP PROJECT, JUNE 1968. (NTIS NO. AD 673136)
DESCRIPTION:

THIS REPORT DISCUSSES A FUNDAMENTAL PRINCIPLE OF OPERATION FOR AN INTERFACE WHICH IS CONCEIVED TO INCREASE THE EFFECTIVENESS OF THE DESIGNER OF DISCRETE ELEMENT SYSTEMS. THE INTERFACE, IMPLEMENTED IN A SMALL COMPUTER WITH INTERACTIVE GRAPHIC CAPABILITIES OPERATING AS A SATELLITE OF A LARGE CENTRAL COMPUTER, HAS BEEN BUILT AND USED. THE INITIAL RESULTS ARE DISCUSSED AND OPEN PROBLEMS FOR FUTURE WORK ARE LISTED. THE APPENDICES INCLUDE A USER'S GUIDE, EXAMPLES, AND DETAILS OF IMPLEMENTATION. (A) 194P, 72R.

COMMENTS:

THIS PAPER BEGINS WITH THE PREMISE THAT A SYSTEM FOR COMPUTER-AUGMENTED DECISION-MAKING MUST ACT AS A TEACHING MACHINE, A COMPUTATION DEVICE, AND AN INFORMATION STORAGE AND RETRIEVAL DEVICE. CONSIDERATIONS IN THE DESIGN OF SUCH A SYSTEM ARE THEN DISCUSSED. ALTHOUGH SOME OF THESE CONSIDERATIONS (E.G. ATTENTION SPAN AND HUMAN INFORMATION PROCESSING ABILITIES) COULD PROFITABLY BE RELATED TO ISSUES IN COGNITIVE PSYCHOLOGY, NO SUCH RELATION IS ATTEMPTED. A NUMBER OF HUMAN FACTORS PROBLEMS ARE DISCUSSED BRIEFLY AND NONTECHNICALLY, BUT THIS PAPER IS CONCERNED MORE WITH THE HARDWARE AND SOFTWARE REQUIREMENTS OF THE MAN-MACHINE INTERFACE THAN WITH HUMAN FACTORS CONSIDERATIONS.

A POTENTIALLY USEFUL DESIGN AID, THE "VARI-PORT LINK," IS DISCUSSED IN SOME DETAIL. THIS AID INTEGRATES VARIABLE NAMES, ALGORITHMS, UNITS OF MEASUREMENT, GRAPHIC DESCRIPTIONS, ETC., AND HELPS TO INSURE DESIGN

CONSISTENCY.

INFORMATION NEEDS OF SCIENTIFIC AND TECHNICAL PERSONNEL ALLEN, T.J. INFORMATION NEEDS AND USES. IN C.A. CUADRA & A.W. LUKE (EDS.), ANNUAL REVIEW OF INFORMATION SCIENCE AND TECHNOLOGY (VOL. 4). CHICAGO: ENCYCLOPEDIA BRITANNICA INC., 1969, 3-29.
DESCRIPTION:

THIS PAPER PROVIDES A LITERATURE REVIEW, UP TO 1969, AND A STATE OF THE ART SUMMARY OF RESEARCH IN INFORMATION NEEDS AND USES. A CONCEPTUAL FRAMEWORK IS ADOPTED IN WHICH AN INDIVIDUAL IS VIEWED AS OPERATING IN A SERIES OF CONCENTRIC SYSTEMS. INFORMATION NEEDS AND USES ARE CONSIDERED WITH RESPECT TO INDIVIDUALS, WORK TEAMS, ORGANIZATIONS, PROFESSIONAL SOCIETIES, "INVISIBLE COLLEGES", AND FORMAL INFORMATION SYSTEMS.

COMMENTS:

THIS ARTICLE IS NOT ABOUT COMPUTERIZED INFORMATION SYSTEMS, BUT ADDRESSES INFORMATION REQUIREMENTS AND COMMUNICATION MECHANISMS IN THE SCIENTIFIC AND TECHNICAL COMMUNITY IN A GENERAL WAY. IT IS A BROAD, FAIRLY ABSTRACT COVERAGE OF THIS TOPIC. IT HAS LITTLE TO CONTRIBUTE TO SPECIFIC SYSTEM DESIGN DECISIONS, BUT THOSE INVOLVED IN THE DEVELOPMENT OF INFORMATION DISSEMINATION AND RETRIEVAL SYSTEMS FOR SCIENTIFIC AND TECHNICAL USERS MAY FIND THIS A GOOD SOURCE OF BACKGROUND INFORMATION FOR THEIR USER REQUIREMENTS DEFINITION ACTIVITIES.

10 GENERAL DISCUSSION OF DECISION SUPPORT SYSTEMS
ALTER, S. WHY IS MAN-COMPUTER INTERACTION IMPORTANT FOR DECISION SUPPORT
SYSTEMS? INTERFACES, FEBRUARY 1977, 7(2), 109-115.
DESCRIPTION:

THIS PAPER ATTEMPTS TO SHED SOME LIGHT ON THE WHOLE ISSUE OF MAN-COMPUTER AINTERACTION. THE BASIC POINT OF THIS PAPER IS THAT WE SHOULD NOT ALLOW OUR TRADITIONAL JARGON TO SHAPE OUR CURRENT THOUGHTS ABOUT THE ON-LINE TOOLS WE USE NOW AND THE INTERACTIVE TOOLS WE MAY USE IN THE FUTURE.

EVER SINTE IT BECAME FEASIBLE TO PROVIDE COMPUTING ENVIRONMENTS WHICH COULD SUPPORT ON-LINE TERMINALS, MANAGEMENT SCIENTISTS HAVE ENJOYED EXTOLLING THE VIRTUES OF THEIR LATEST INTERACTIVE DECISION SUPPORT SYSTEMS. IN EVALUATING THIS CLIMATE OF OPINION, IT BECAME CLEAR THAT SOMETHING WAS DRASTICALLY WRONG. THE ILL-DEFINED, BUT SOMEHOW ANTICIPATED "SYNERGY" OF MAN AND MACHINE JUST DIDN'T SEEM TO PAN OUT IN A SUFFICIENTLY DRAMATIC WAY TO JUSTIFY ALL THE ATTENTION AND ANTICIPATION. ALTHOUGH A SUBSTANTIAL NUMBER OF SYSTEMS DID DELIVER COMPUTING POWER IN AN ON-LINE ENVIRONMENT, THE IMPACT OF MAN-COMPUTER INTERACTION ON THE END RESULT WAS ALMOST ALWAYS EXTREMELY DIFFICULT FOR USEPS TO DEFINE. (A, ABBR) 7P, SR.

COMMENTS:

THIS PAPER IS CONCERNED WITH DECISION SUPPORT SYSTEMS. ALTHOUGH SOME OF THE AUTHOR'S DBSERVATIONS ARE PESSIMISTIC, THEY ARE, IN GENERAL, TRUE. HIS MAIN POINTS ARE THAT CURRENT SYSTEMS DO NOT ENTICE EXECUTIVES TO USE THEM, NON-EXPERTS SHOULD BE DISCOURAGED FROM USING DECISION SUPPORT SYSTEMS, ON-LINE SYSTEMS CAN INCREASE EFFICIENCY AND CONVENIENCE, AND INTERACTIVE SYSTEMS CAN AID SUBSTANTIALLY IN GROUP PLANNING. A FINAL POINT IS THAT INTERACTIVE SYSTEMS ARE NOT REALLY INTERACTIVE. THE AUTHOR ARGUES THAT A DECISION SUPPORT SYSTEM SHOULD BE RESPONSIVE, RATHER THAN INTERACTIVE, WHERE RESPONSIVE IS DEFINED AS POWERFUL, ACCESSIBLE, AND FLEXIBLE. THIS PAPER ARGUES FOR RESPONSIVE SYSTEMS, BUT DOES NOT OFFER SUGGESTIONS AS TO HOW THEY SHOULD BE DEVELOPED.

11 MAN-COMPUTER DIALOGUE
AMBROZY, D. ON MAN-COMPUTER DIALOGUE. INTERNATIONAL JOURNAL OF MAN-MACHINE
STUDIES, 1971, 3, 375-383.
DESCRIPTION:

EVERY MAN-COMPUTER INTERACTION INVOLVES SOME KIND OF DIALOGUE; HOWEVER IT IS NOT YET FULLY CLEAR WHAT KIND OF ACTIVITY CAN BE CALLED A DIALOGUE AND HOW TO CALCULATE ITS SIMPLER PARAMETERS.

THIS PAPER SURVEYS SOME ASPECTS OF THE SEEMINGLY SIMPLE PROBLEM AND PRESENTS A FORMULATION OF THE DIALOGUE AND OF THE BASIC HUMAN FACTOR INFLUENCING ITS COURSE: THE SPECIFIC FATIGUE ASSOCIATED WITH THE INFORMATION PROCESSING WORK OF THE HUMAN NERVOUS SYSTEM. (A)

AFTER DESCRIBING THE RULES AND COMPLICATIONS OF DIALOGUES, THE AUTHOR DERIVES EQUATIONS TO EXPRESS THE AMOUNT OF WORK REQUIRED FOR A DIALOGUE AND THE PERFORMANCE OF A DIALOGUE SYSTEM. HUMAN FATIGUE IS A FUNCTION OF THE DEMANDS ON MAN'S LIMITED INFORMATION PROCESSING CHANNEL CAPACITY. ONE METHOD FOR IMPROVING DIALOGUE PERFORMANCE IS TO REDUCE THE NECESSARY LOW-LEVEL INFORMATION PROCESSING ASSOCIATED WITH OPERATING INFORMATION RETRIEVAL AND PRESENTATION DEVICES.

COMMENTS:

IT IS DIFFICULT TO ARGUE WITH MOST OF WHAT THIS PAPER HAS TO SAY, BUT IT IS ALSO DIFFICULT TO FIND MUCH HERE THAT WILL HELP US UNDERSTAND OR IMPROVE MAN-COMPUTER DIALOGUE. THE AUTHOR'S INFORMATION-THEORY ORIENTATION MAY BE HELPFUL TO SOME READERS AND HIS APPLICATION OF THAT ORIENTATION TO THE COMMUNICATION QUANTITY AND RATE OF MAN-COMPUTER DIALOGUE SEEMS SOUND. HOWEVER, NEITHER THE MATHEMATICAL TREATMENT NOR THE ASSUMPTION OF THREE MERVOUS SYSTEM "FATIGUE" EFFECTS SEEMS NECESSARY TO THE AUTHOR'S PRINCIPAL CONCLUSION: REDUCTION OF THE AMOUNT OF LOW-LEVEL INFORMATION PROCESSING REQUIRED OF THE USER (IN A DATA-LIMITED PROBLEM-SOLVING SETTING) WILL IMPROVE MAN-COMPUTER SYSTEM PERFORMANCE. FURTHERMORE, OPERATIONAL DEFINITIONS OF HIS TERMS ARE HARD TO COME BY (WHAT IS A "BIT" OF HIGH-LEVEL INFORMATION PROCESSING?). THE READER WHO IS TRYING TO GAIN A VERY HIGH-LEVEL PERSPECTIVE WITH RESPECT TO MAN-COMPUTER COMMUNICATION MAY FIND THIS PAPER HELPFUL; OTHERS PROBABLY WILL GAIN LITTLE FROM IT.

ALLOCATION OF TASKS IN COMMAND-AND-CONTROL SYSTEMS
AMMERMAN, H.L., & MELCHING, W.H. MAN IN CONTROL OF HIGHLY AUTOMATED SYSTEMS
(PROFESSIONAL PAPER 7-71). ALEXANDRIA, VIRGINIA: HUMAN RESOURCES RESEARCH
ORGANIZATION, MAY 1971 (PAPER PRESENTED AT 16TH ANNUAL ARMY HUMAN FACTORS
RESEARCH AND DEVELOPMENT CONFERENCE, FT. BLISS, TX, OCTOBER 197D). (NTIS NO.
AD 727658)

THE IDENTIFICATION OF WHAT MAN SHOULD DO AS A DECISION MAKER AND CONTROLLER IN THE NEWLY EVOLVING MAN-MACHINE SYSTEMS IS CONSIDERED. AMONG THE TOPICS DISCUSSED ARE MAN'S UNDERLYING BASIC FUNCTIONS IN A COMPLEX SYSTEM, TASK ACTIVITIES FOR INDIVIDUAL JOBS AND THEIR ANALYSES, AND TRAINING AND THE DESIGN OF OPERATIONAL JOB POSITIONS. (A) 14P, 1R.

COMMENTS:

DESCRIPTION:

THIS IS A BRIEF, INSIGHTFUL DISCUSSION OF HUMAN FACTORS CONSIDERATIONS IN THE DESIGN OF COMMAND AND CONTROL SYSTEMS. THE AUTHORS' PRINCIPAL CONCERN IS WITH A WELL-CONSIDERED ALLOCATION OF TASKS, NOT ONLY BETWEEN MAN AND COMPUTER, BUT ALSO AMONG TEAM MEMBERS WHO MAY BE USERS OF AN INFORMATION SYSTEM OR MAY PERFORM MANUAL OPERATIONS IN ITS SUPPORT. THEY DISCUSS A NUMBER OF FACTORS WHICH SHOULD BE CONSIDERED WHEN SPECIFYING THE INDIVIDUAL RESPONSIBILITIES OF TEAM MEMBERS IN ORDER TO INSURE THAT THEIR FUNCTIONS ARE WELL COORDINATED, INTERNALLY CONSISTENT, AND INTRINSICALLY MOTIVATING. THE PAPER SHOULD BE OF INTEREST TO THOSE CONCERNED WITH COMMAND AND CONTROL IN PARTICULAR, BUT IS MORE BROADLY APPLICABLE TO ALL COMPLEX SYSTEMS INVOLVING TEAMS OF USERS.

13 USE OF PRODUCTION SYSTEMS FOR DIALOGUE CONTROL, PROBLEM-SOLVING AIDS ANDERSON, R.H., & GILLOGLY, J.J. RAND INTELLIGENT TERMINAL AGENT (RITA): DESIGN PHILOSOPHY (REPORT NO. R-1809-ARP1). SANTA MONICA, CALIFORNIA: RAND CORP., 1976.
DESCRIPTION:

THE RAND INTELLIGENT TERMINAL AGENT (RITA) IS A SET OF COMPUTER PROGRAMS RESIDING IN A POP-11/45 MINICOMPUTER. THESE PROGRAMS ARE CAPABLE OF ACTING AS A "USER AGENT" WHICH CAN PERFORM A VARIETY OF TASKS, BOTH UNDER DIRECT USER CONTROL AND OPERATING SEMIAUTONOMOUSLY OVER EXTENDED PERIODS OF TIME, AMONG THESE TASKS ARE (1) FILING, RETRIEVING, AND EDITING OF DATA ON LOCAL STORAGE FILES, (2) HANDLING INTERACTIVE DIALOGS WITH EXTERNAL INFORMATION SYSTEMS AVAILABLE OVER EITHER TELEPHONE LINES OR THE ARPANET, (3) PROVIDING LOCAL TUTORIAL FUNCTIONS AND ERROR-CHECKING OF INPUT DATA, AND (4) HEURISTIC MODELING OF A LIMITED SUBJECTIVE SET OF RELATIONSHIPS.

FOR A USER AGENT TO BE HELPFUL TO PERSONS WHO ARE NOT PROGRAMMERS OR "COMPUTER SOPHISTICATES," IT MUST IN OUR OPINION (1) BE CAPABLE OF EXPLAINING ITS BEHAVIOR UPON REQUEST, (2) BE CAPABLE OF HAVING ITS BEHAVIOR MODIFIED BY THE USER HIMSELF, (3) BE ABLE TO BE GOVERNED BY SETS OF HEURISTICS STATED AS RULES, RATHER THAN AS FORMAL ALGORITHMS, AND (4) RETAIN A MEMORY OF TASKS ASSIGNED, PROGRESS, SCHEDULES, AND DEADLINES IN SPITE OF EITHER SCHEDULED OR UNSCHEDULED SYSTEM MAINTENANCE PERIODS OR "CRASHES" (UNPLANNED SYSTEM FAILURES REQUIRING EXECUTION OF A RESTART PROCEDURE). THE RITA SYSTEM MEETS THESE DESIGN OBJECTIVES PRIMARILY BY USING PRODUCTION SYSTEMS: SETS OF PREDICATE-ACTION RULES OPERATING UPON A DATA BASE UNDER THE GUIDANCE OF A RULE INTERPRETER, OR MONITOR. (A, ABBR.) 62P, 16R.

COMMENTS:

THE USE OF PRODUCTION SYSTEMS AS A MECHANISM FOR DIALOGUE CONTROL IN INTELLIGENT TERMINALS IS CONSIDERED IN DETAIL BY R.H. ANDERSON AND W.L. SHIPLEY (1972). THE PRESENT PAPER BRIEFLY REVIEWS PRODUCTION SYSTEMS AS THEY ARE USED IN RITA, DISCUSSES DESIGN CONSTRAINTS AND DESIGN REQUIREMENTS FOR RITA, AND GIVES EXAMPLES OF THE OPERATION OF A PROTOTYPE SYSTEM. PRODUCTION SYSTEMS, AS IMPLEMENTED IN RITA, APPEAR TO OFFER SEVERAL ADVANTAGES FOR THE INEXPERIENCED COMPUTER USER. THE PRINCIPAL ADVANTAGES ARE THE ABILITY OF THE SYSTEM TO EXPLAIN ITS BEHAVIOR TO THE USER AND ALLOWING THE USER TO MODIFY OR EXTEND THE PRODUCTION SYSTEM RULES. THIS LATTER FACT IMPLIES THAT THE SYSTEM CAN BE "TAILORED" TO MATCH THE USER'S LEVEL OF SOPHISTICATION. THE ACTUAL USEFULNESS OF RITA, HOWEVER, DEPENDS STRONGLY ON THE NATURE OF THE MAN-COMPUTER INTERFACE EMPLOYED AND, AS INDICATED IN THIS PAPER, THE INTERFACE IS CURRENTLY UNDER DEVELOPMENT.

14 USE OF PRODUCTION SYSTEMS FOR DIALOGUE CONTROL
ANDERSON, R.H., & SIBLEY, W.L. A NEW APPROACH TO PROGRAMMING MAN-MACHINE
INTERFACES (TECHNICAL REPORT R-876-ARPA). SANTA MONICA, CALIFORNIA: RAND
CORP., MARCH 1972. (NTIS NO. AD 742755)
DESCRIPTION:

THIS REPORT DISCUSSES THE APPLICATION OF RECENT DEVELOPMENTS IN JEB LANGUAGES AND MACHINE LEARNING OF HEURISTICS TO PROBLEMS IN PROGRAMMING A FLEXIBLE INTERFACE MECHANISM BETWEEN A USER AND AN APPLICATION PROGRAM. THIS REPORT CONSIDERS AN ADAPTIVE COMMUNICATOR INTERPOSED BETWEEN AN APPLICATION PROGRAM AND A SET OF INPUT/OUTPUT DEVICES. THE COMMUNICATOR IS COUPLED WITH THESE I/O DEVICES BY PROGRAMS THAT TRANSFORM RAW SIGNALS FROM THEM INTO LOW-LEVEL LOGICAL OBJECTS. THE COMMUNICATOR IS ENVISIONED AS A SERIES OF CONTEXT—ANALYSIS SYSTEMS, EACH HAVING A SEPARATE CONTEXT AND SET OF OPERATING RULES, AND COMMUNICATING WITH EACH OTHER BY TRANSMITTING LOGICAL OBJECTS. THE REPORT CONCLUDES THAT: (1) A LABELLED DIRECTED GRAPH, OR WEB, IS AN APPROPRIATE DATA—BASE ORGANIZATION FOR MAN—MACHINE INTERACTION, (2) WEB GRAMMARS, IN THE FORM OF PATTERN—REPLACEMENT RULES, CAN BE USED TO MANIPULATE THAT DATA BASE, (3) PATTERN—REPLACEMENT RULES CAN BE VIEWED AS HEURISTICS SUITABLE FOR MACHINE LEARNING. (A) 36P, 11R.

COMMENTS:

PRODUCTION SYSTEMS, ADVOCATED HERE AS A MECHANISM FOR DIALOGUE CONTROL IN "INTELLIGENT" TERMINALS, HOLD CONSIDERABLE LONG-TERM PROMISE AS A MEANS OF RELIEVING THE COMPUTER USER OF MUCH LOW-LEVEL INFORMATION PROCESSING, AND SHOULD CONTRIBUTE TO THE DEVELOPMENT OF MORE POWERFUL AIDS FOR DECISION MAKING AND PROBLEM SOLVING, AS WELL AS SIMPLE INFORMATION RETRIEVAL TASKS. IT SEEMS LIKELY THAT USE OF SUCH SYSTEMS WILL BE RESTRICTED TO THE RESEARCH AND DEVELOPMENT COMMUNITY FOR SOME TIME TO COME, HOWEVER. IN SITUATIONS SUFFICIENTLY COMPLEX TO REALLY NEED THE POWER OF PRODUCTION SYSTEMS, DEVELOPMENT OF A SATISFACTORY SET OF PRODUCTION RULES IS A NONTRIVIAL ACTIVITY. THE PROMISE IS REAL, HOWEVER, AND THE GROUP WHICH PUBLISHED THIS REPORT HAS SINCE IMPLEMENTED A PROTOTYPE SYSTEM (RITA) BASED ON THESE CONCEPTS (SEE ANDERSON, R.H., & GILLOGLY, J.J., 1976). A DANGER TO BE KEPT IN MIND IS THAT SUCH SYSTEMS NATURALLY LEND THEMSELVES TO THE SPECIFICATION OF COMPLEX AND SUBTLE PROCEDURES. CARE WILL BE REQUIRED TO PREVENT AN APPEARANCE OF UNPREDICTABILITY TO THE NONTECHNICAL USER. THUS, UNTIL DEVELOPMENT HAS MADE THESE SYSTEMS VERY GOOD, THEY ARE LIKELY TO BE VERY BAD FOR PRODUCTION USE, EXCEPT FOR SIMPLE FUNCTIONS WHICH DON'T REALLY REQUIRE THEIR POWER. THIS PAPER IS CONCERNED ALMOST EXCLUSIVELY WITH THE NATURE OF PRODUCTION SYSTEMS AND WITH A GRAPHICAL TECHNIQUE FOR REPRESENTING THEM; READERS WITH A LESS TECHNICAL INTEREST SHOULD CONSULT THE ANDERSON AND GILLOGLY PAPER.

### 15 TERMINALS

ANTONELLI, D.C. TERMINAL DESIGN: A CHALLENGE TO HUMAN FACTORS. IN MAN-COMPUTER INTERACTION (PROCEEDINGS, CONFERENCE ON MAN-COMPUTER INTERACTION, 2-4 SEPTEMBER 1970, CONFERENCE PUBLICATION NO. 68). LONDON, ENGLAND: INSTITUTION OF ELECTRICAL ENGINEERS, 1970, 95-101.

DESCRIPTION:

INTERACTIVE TERMINALS ARE A RELATIVELY NEW ADDITION TO THE FIELD OF COMPUTER USAGE. THE GROWTH OF MANUFACTURERS AND USER SOPHISTICATION WILL LEAD TO A RAPID PROLIFERATION IN THE NUMBER OF DEVICES AVAILABLE. THE CHALLENGE FOR HUMAN FACTORS IS TO IDENTIFY THE USERS' NEEDS AND LIMITS TO AID IN THE SELECTION OF EXISTING TERMINALS AND TO HELP DETERMINE THE CHARACTERISTICS THAT SHOULD BE INCORPORATED INTO TERMINAL DESIGN. THIS PAPER CONSIDERS HUMAN FACTORS PROBLEMS THAT CURRENTLY FACE THE DESIGNER OF INTERACTIVE TERMINALS, THE PROBLEMS THAT WE CAN ANTICIPATE FROM THE NEXT GENERATION OF TERMINALS, AND SOME APPROACHES THAT SHOULD BE IMPLEMENTED IN ORDER TO RESOLVE THESE PROBLEMS.

### COMMENTS:

THIS PAPER ACTUALLY DISCUSSES VERY FEW HUMAN FACTORS ISSUES IN TERMINAL DESIGN. THE "CURRENT" ISSUES DISCUSSED INCLUDE ONLY NOISE, RESPONSE TIME, AND EASE OF OPERATION. THE "FUTURE" PROBLEMS CENTER PRIMARILY ON THE WIDE VARIETY OF APPLICATION AREAS IN WHICH INTERACTIVE TERMINALS CAN BE USED. THE APPROACH TO HUMAN FACTORS RESEARCH, ALTHOUGH ONLY BRIEFLY DISCUSSED, MAY HAVE SOME MERIT. THE PRINCIPAL POINT OF THIS APPROACH IS THAT THE TOTAL SYSTEM SHOULD BE OBSERVED, RATHER THAN CONSIDERING INDIVIDUALLY EACH OF THE RELEVANT PARAMETERS, SO THAT INTERACTIONS BETWEEN THESE PARAMETERS OR SYSTEM COMPONENTS CAN BE OBSERVED.

### 16 GRAPHICAL CRT DISPLAYS

APPEL, A., DANKOWSKI, T.P., & DOUGHERTY, R.L. ASPECTS OF DISPLAY TECHNOLOGY. IBM SYSTEMS JOURNAL, 1968, 7, 176-187.

DESCRIPTION:

THIS ARTICLE BRIEFLY DISCUSSES MODERN CRT DISPLAY TERMINAL TECHNOLOGY FROM THE POINT OF VIEW OF THE USER. BOTH RASTER SCAN AND VECTOR GRAPHIC DISPLAY TERMINALS ARE DISCUSSED, AS WELL AS THE VARIOUS INPUT DEVICES FREQUENTLY FOUND IN SUCH TERMINALS. THE PROPERTIES OF THE IBM 2250 REFRESHED VECTOR GRAPHIC DISPLAY TERMINAL ARE DISCUSSED IN SOMEWHAT GREATER DETAIL. 12P, 16R.

### COMMENTS:

ALTHOUGH THIS PAPER DOES NOT CONTAIN A PARTICULARLY DEEP DISCUSSION OF HUMAN FACTORS ISSUES IN GRAPHICAL CRT TERMINAL DESIGN, IT FILLS A VOID LEFT BY MOST OTHER PAPERS IN THE AREA BY RELATING SOME OF THE USER-OBSERVED FUNCTIONAL PROPERTIES OF SUCH DEVICES TO SPECIFIC HARDWARE AND SOFTWARE FRATURES OF THE DISPLAY. THE EMPHASIS IS ON A PARTICULAR DISPLAY DEVICE, BUT SOME OF THE DISCUSSION IS GENERAL, AND THE PAPER MAY HELP THOSE CONCERNED WITH THE DESIGN OR SELECTION OF SUCH TERMINALS.

# 17 OPTICAL CHARACTER RECOGNITION

APSEY, R.S. HUMAN FACTORS OF CONSTRAINED HANDPRINT FOR OCR. IN PROCEEDINGS, IEEE INTERNATIONAL CONFERENCE ON CYBERNETICS AND SOCIETY, NOVEMBER 1976.
NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., 1976, 466-470.

### DESCRIPTION:

THIS PAPER DESCRIBES THE RESULTS OF A CONTROLLED STUDY OF THE HANDPRINTING OF NUMERIC AND ALPHANUMERIC CHARACTERS FOR INPUT TO OPTICAL CHARACTER READERS (OCR'S). THE PURPOSE OF THE STUDY WAS TO EVALUATE THE ABILITY OF PEOPLE TO HANDPRINT VARIOUS CONSTRAINED FONTS USING DIFFERENT PREPRINTED GUIDANCE SCHEMES, AND COMPARE THEIR PERFORMANCE TO UNCONSTRICTED HANDPRINTING.

HANDPRINTING PERFORMANCE WAS EVALUATED UNDER THE FOLLOWING CONDITIONS: UNCONSTRICTED HANDPRINT, ANSI HANDPRINT, SQUARE FONT, ROUND FONT, AMD MARK READ. (A, ABBR.)
5P, OR.

### COMMENTS:

THE AUTHOR CLEARLY PRESENTS EXAMPLES OF THE HANDPRINTING FONTS USED AND THE PREPRINTED GUIDES USED FOR CONSTRAINED HANDPRINTING. ALTHOUGH THE EXPERIMENT REPORTED IN THIS PAPER APPEARS TO HAVE BEEN CAREFULLY DESIGNED AND CONDUCTED, THE DATA ARE NOT ANALYZED APPROPRIATELY. THE AUTHOR PRESENTS SUMMARY DATA AND DRAWS CONCLUSIONS ON THE BASIS OF THESE DATA, BUT THESE CONCLUSIONS ARE APPARENTLY NOT SUPPORTED BY STATISTICAL ANALYSIS. IN ADDITION, THE AUTHOR CONCLUDES THAT CONSTRAINED HANDPRINTING IS UNACCEPTABLE BECAUSE OF THE SEVERE REDUCTIONS IN PRINTING SPEED. THERE IS A TRADEOFF, HOWEVER, BETWEEN PRINTING SPEED AND THE EFFORT THAT MUST BE EXPENDED IN SUBSEQUENT PROCESSING OF THE DATA. THIS TRADEOFF IS NOT CONSIDERED IN THIS PAPER, BUT IT IS CLEARLY AN IMPORTANT FACTOR IN DETERMINING THE FEASIBILITY OF USING CONSTRAINED PRINTING AND OPTICAL CHARACTER READERS. NEVERTHELESS, THIS PAPER DOES ADEQUATELY DESCRIBE THE TECHNIQUES EMPLOYED IN CONSTRAINED HANDPRINTING AND WOULD BE OF INTEREST TO THOSE CONCERNED WITH THIS AREA.

# 18 BIBLIOGRAPHIC SYSTEMS

ATHERTON, P. BIBLIOGRAPHIC DATA BASES: THEIR EFFECT ON USER INTERFACE DESIGN IN INTERACTIVE RETRIEVAL SYSTEMS. IN D.E. WALKER (ED.), INTERACTIVE BIBLIOGRAPHIC SEARCH: THE USER/COMPUTER INTERFACE. MONTVALE, NJ: AFIPS PRESS, 1971, 215-223.

### DESCRIPTION:

THIS PAPER EXAMINES THE CURRENT STATUS OF INTERACTIVE BIBLIOGRAPHIC RETRIEVAL SYSTEMS. THE FOCUS IS ON ASKING QUESTIONS AND IDENTIFYING PROBLEM AREAS RATHER THAN ON PROVIDING ANSWERS. THE PRINCIPAL ADVANTAGE OF AN INTERACTIVE RETRIEVAL SYSTEM SHOULD BE THAT IT BRINGS THE DATA TO THE USER RATHER THAN FORCING THE USER TO GO TO THE DATA. SEVERAL AREAS ARE IDENTIFIED THAT CURRENTLY PREVENT THIS ADVANTAGE FROM BEING REALIZED.

9P, 10R.

### COMMENTS:

THIS PAPER PROVIDES A LOW-LEVEL REVIEW OF SOME PROBLEMS ASSOCIATED WITH INTERACTIVE RETRIEVAL SYSTEMS. ALTHOUGH THE AUTHOR DOES NOT PRESENT A DETAILED DISCUSSION OF EXISTING SYSTEMS, SHE DOES CLEARLY POINT OUT PROBLEM AREAS THAT ARE COMMON TO ALL SUCH SYSTEMS AND PROBLEMS THAT ARISE WHEN INDIVIDUAL BIBLIOGRAPHIC SYSTEMS ARE INTEGRATED INTO A SINGLE SYSTEM. THESE PROBLEMS CENTER ON LACK OF STANDARDIZATION IN CONSTRUCTING DATA BASES AND ON DIFFERENT VIEWS OF THE USERS' REQUIREMENTS. THE IDEAS EXPRESSED IN THIS PAPER UNDERSCORE THE NEED FOR OPEN AND EFFECTIVE COMMUNICATION BETWEEN RESEARCHERS IN A GIVEN PROBLEM AREA AND ON THE NECESSITY OF A COMMON COMPREHENSIVE AND WELL-UNDERSTOOD THEORETICAL FRAMEWORK.

19 INTERACTIVE GRAPHICS

ATKINSON, P., DALVI, V.S., DRAWNEEK, E.A., FELLGETT, P.B., HOVLAND, H.L., TRING, R.W.H., WALKER, B.S., & WHITFIELD, G.R. THE PICASSO LOW-COST SYSTEM IN RELATION TO GRAPHIC COMMUNICATION AS A NATURAL LANGUAGE FOR MAN-COMPUTER INTERACTION. IN MAN-COMPUTER INTERACTION (PROCEEDINGS, CONFERENCE ON MAN-COMPUTER INTERACTION, 2-4 SEPTEMBER 1970) (CONFERENCE PUBLICATION NO. 68). LONDON, ENGLAND: INSTITUTION OF ELECTRICAL ENGINEERS, 1970, 172-180. DESCRIPTION:

AFTER THE DEVELOPMENT OF SPEECH ITSELF, THE INVENTION OF WRITING AND ITS EXTENSION BY THE TECHNOLOGICAL ADWANCE OF PRINTING ARE GENERALLY RECOGNIZED AS KEY DEVELOPMENTS OF OUR CULTURE. ALTHOUGH PAPER IS AN EXCELLENT MEDIUM FOR RECORDING AND HELPING US TO VISUALIZE THE SYMBOLS OF OUR ABSTRACT MENTAL STRUCTURES, IT IS NOT IDEAL FOR SYMBOL MANIPULATION. IT IS SURPRISING THAT THE COMPUTER HAS HITHERTO MADE SO LITTLE CONTACT WITH THIS NEED, WHICH IT IS QUITE EVIDENTLY WELL ADAPTED TO FILL.

WE NEED TO INTERACT WITH A COMPUTER GRAPHICALLY IN THE MANY TASKS FOR WHICH GRAPHICAL REPRESENTATION IS THE NATURAL LANGUAGE, AND INDEED OFTEN THE ONLY SATISFACTORY ONE. HITHERTO INTERACTIVE GRAPHICS HAVE BEEN TOO EXPENSIVE FOR COMMON USE. WE BELIEVE OUR EXPERIENCE ALREADY DEMONSTRATES THAT THIS NEED NOT BE SO. THE AVAILABILITY OF INTERACTIVE GRAPHICS IN OUR LABORATORY HAS BEEN FOUND TO BE A POWERFUL STIMULUS TO THE DEVELOPMENT AND ROUTINE USE OF NEED-ORIENTED PROGRAMS. THE GENERAL AVAILABILITY OF LOW-COST GRAPHICS COULD CAUSE AN EXPLOSION IN A NEW FORM OF COMPUTER USE. (A, ABBR.)

9P, 3R.

COMMENTS:

THE GRAPHICS SYSTEM DESCRIBED IN THIS PAPER CONSISTS OF AN INPUT TABLET AND A CRT. THE AUTHORS PROVIDE A VERY BRIEF DISCUSSION OF THE RELATIVE MERITS OF VARIOUS INPUT DEVICES. NO CONSIDERATION IS GIVEN, HOWEVER, TO OTHER AREAS SUCH AS DISPLAY FORMAT OR THE NATURE OF THE INTERACTIVE DIALOGUE. SEVERAL APPLICATIONS, PRIMARILY CONCERNED WITH COMPUTER-AIDED DESIGN, ARE ALSO MENTIONED. IN GENERAL, THE AUTHORS CLAIM TO HAVE DEVELOPED A FAIRLY LOW-COST INTERACTIVE SYSTEM THAT HAS A HIGH DEGREE OF USER ACCEPTANCE. THIS PAPER IS TOO BRIEF, HOWEVER, TO FULLY SUBSTANTIATE THIS CLAIM. A LOW-COST SYSTEM MOST LIKELY HAS SOME LIMITATIONS AND IT APPEARS NECESSARY TO CONSIDER THOSE APPLICATION AREAS IN WHICH THESE LIMITATIONS WOULD NOT SERIOUSLY DEGRADE OVERALL PERFORMANCE.

20 USER INTERFACES FOR BIBLIOGRAPHIC SYSTEMS
BACK, H.B. WHAT INFORMATION DISSEMINATION STUDIES IMPLY CONCERNING THE
DESIGN OF ON-LINE REFERENCE RETRIEVAL SYSTEMS. JOURNAL OF THE AMERICAN
SOCIETY FOR INFORMATION SCIENCE, 1972, 23, 156-163.
DESCRIPTION:

THE USE OF AN ON-LINE COMPUTER SYSTEM FOR LOCATING BIBLIOGRAPHIC CITATIONS HAS BEEN HAILED AS AN IMPORTANT INNOVATION FOR COPING WITH THE "INFORMATION EXPLOSION." HOWEVER, ON-LINE REFERENCE RETRIEVAL IS ONLY ONE ELEMENT IN A LARGE SOCIAL SYSTEM OF INFORMATION DISSEMINATION. TO HAVE A WIDESPREAD IMPACT, AN ON-LINE SYSTEM MUST COMPETE SUCCESSFULLY WITH A MULTITUDE OF OTHER SOURCES OF REFERENCES. THIS PAPER REVIEWS STUDIES OF INFORMATION DISSEMINATION AS A BASIS FOR DETERMINING HOW ON-LINE RETRIEVAL CAN BEST COMPETE. IT RECOMMENDS THE FUNCTIONAL GROUPS FOR WHOM AN ON-LINE SYSTEM SHOULD BE DESIGNED INITIALLY, AND SUGGESTS THE USES FOR WHICH THE SYSTEM SHOULD BE DESIGNED AND THE FORMS OF WRITTEN MEDIA THAT SHOULD BE INCLUDED IN THE SYSTEM'S INITIAL DATA BASE. FINALLY, IT PRESENTS CRITERIA THE SYSTEM SHOULD SATISFY TO BE AS WIDELY USED AND COMPREHENSIVE AS OTHER REFERENCE RETRIEVAL METHODS. (A)

COMMENTS:

THE AUTHOR DOES A FAIRLY GOOD JOB OF IDENTIFYING THE TYPES OF PERSONS WHO WOULD BENEFIT MOST FROM AN ON-LINE REFERENCE RETRIEVAL SYSTEM (RESEARCHERS AND EDUCATORS) AND THE TYPES OF INFORMATION THAT SHOULD BE INCLUDED IN THE DATA BASE. USER REQUIREMENTS AND USER ACCEPTANCE ARE EMPHASIZED AND THIS SHOULD SIGNIFICANTLY AID IN THE DESIGN OF INTERACTIVE RETRIEVAL SYSTEMS. THE DESIGN CRITERIA THAT ARE DISCUSSED, HOWEVER, ARE FAIRLY HIGH-LEVEL AND ABSTRACT AND ADD LITTLE TO THE AUTHOR'S DISCUSSIONS. FOR EXAMPLE, IT SEEMS OBVIOUS THAT AN INTERACTIVE RETRIEVAL SYSTEM SHOULD MINIMIZE THE EFFORT REQUIRED TO USE IT AND MAXIMIZE THE QUALITY OF THE OUTPUT. WHAT IS NEEDED ARE GUIDELINES AND SUGGESTIONS AS TO HOW THESE CRITERIA CAN BE ATTAINED.

21 SIMULATION AS SYSTEM EVALUATION TECHNIQUE
BAILEY, R.W. TESTING MANUAL PROCEDURES IN COMPUTER-BASED BUSINESS
INFORMATION SYSTEMS. IN PROCEEDINGS OF THE 16TH ANNUAL MEETING OF THE
HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1972,
395-401.
DESCRIPTION:

TESTING MANUAL PROCEDURES IN COMPUTER-BASED BUSINESS INFORMATION SYSTEMS IS CARRIED OUT TO IDENTIFY DEFICIENCIES AND INCONSISTENCIES THAT MAY KEEP THE SYSTEM FROM MEETING SPECIFIED OBJECTIVES OR REDUCE THE PROBABILITY OF USER ACCEPTANCE. AN EFFECTIVE TESTING PROGRAM WILL ALSO HELP REDUCE OPERATIONAL COSTS. THE TESTING BEGINS AS EARLY IN THE DESIGN PROCESS AS POSSIBLE AND CONTINUES UNTIL AFTER THE SYSTEM IS IN OPERATION. POSITION PACKAGE TESTING IS ONE OF THE MOST CRITICAL OF THE SIX TEST STEPS THAT ARE PART OF THE BELL LABORATORIES PERSONNEL SUBSYSTEM TESTING PROGRAM. DURING A POSITION PACKAGE TEST, NOT ONLY MANUAL PROCEDURES, BUT FORMS, PERFORMANCE AIDS, TRAINING MATERIALS, ETC., ARE EVALUATED UNDER RIGOROUSLY CONTROLLED CONDITIONS, USING REPRESENTATIVE SUBJECTS. A TEST REPORT CONTAINS QUANTITATIVE RESULTS AND RECOMMENDATIONS, WHICH NOT ONLY REPORT THE NUMBERS AND KINDS OF ERRORS THAT ARE BEING COMMITTED, BUT ALSO THE PROBABLE CAUSES FOR THESE SEVEN MAJOR CAUSAL FACTORS ARE DISCUSSED, WHICH ARE CONSIDERED RESPONSIBLE FOR HUMAN GENERATED ERRORS. THE TESTING METHODOLOGY REQUIRES THAT ACCURACY OBJECTIVES FOR DATA ITEMS BE SET BEFORE TESTING BEGINS. THE ESTIMATED ERROR RATES THAT ARE DERIVED FROM THE TESTS FOR EACH DATA ITEM ARE THEN COMPARED WITH THE ACCURACY OBJECTIVES. THIS COMPARISON IS MADE TO DETERMINE WHAT CHANGES WILL BE REQUIRED BEFORE THE SYSTEM IS CAPABLE OF MEETING ITS PERFORMANCE OBJECTIVES. 7P, OR.

COMMENTS:

THE TESTING PROCEDURE PROPOSED IN THIS PAPER INVOLVES THE DETAILED SIMULATION OF A SYSTEM AS A DESIGN VALIDATION TECHNIQUE. THE PRIMARY ADVANTAGES OF THIS PROCEDURE ARE THAT IT ALLOWS FOR A DETAILED VALIDATION OF A PROPOSED SYSTEM DESIGN AND IT PROVIDES A MECHANISM FOR THE EARLY DETECTION OF DESIGN ERRORS. THE PRINCIPAL DISADVANTAGE IS THAT IT REQUIRES THE DEVELOPMENT OF COMPLETE DOCUMENTATION, TRAINING MATERIALS, ETC. BECAUSE THE DEVELOPMENT OF SUCH MATERIALS AND THE ADMINISTRATION OF THE SIMULATED PROCEDURES TEND TO BE COSTLY AND TIME-CONSUMING, THE TECHNIQUE MAY BE PRACTICAL ONLY FOR LARGE SYSTEMS, OR AT LEAST SYSTEMS FOR WHICH A LONG DEVELOPMENT TIME IS TOLERABLE.

CUSTOMIZATION AND TRANSFER OF SYSTEM TO USER GROUPS
BAIR, J.H. STRATEGIES FOR THE HUMAN USE OF A COMPUTER-BASED SYSTEM. PAPER
PRESENTED AT NATO ADVANCED STUDY INSTITUTE ON MAN-COMPUTER INTERACTION, MATI,
GREECE, SEPTEMBER 1976 (REPRINTED BY STANFORD RESEARCH INSTITUTE, MENLO PARK,
CALIFORNIA).
DESCRIPTION:

THE PURPOSE OF THIS PAPER IS TO DESCRIBE A COMPREHENSIVE APPROACH TO THE TRANSFER AND APPLICATION OF A SYSTEM FOR ACCOMPLISHING MAN'S INFORMATION ACTIVITIES. THE COMPLETED SYSTEM HAS BEEN DEVELOPED BY THE AUGMENTATION RESEARCH CENTER, STANFORD RESEARCH INSTITUTE DURING THE PAST FOURTEEN YEARS. THE TWO MAJOR COMPONENTS OF THE SYSTEM DESCRIBED HERE ARE THE TRANSFER STRATEGY OF THE TECHNOLOGY INTO A DISTRIBUTED COMMUNITY, AND THE DEVELOPMENT OF APPLICATION MODELS WITHIN PARTICIPANT GROUPS AND ORGANIZATIONS. THE INTERFACE TO THE GENERAL-PURPOSE COMPUTER TECHNOLOGY IS DESCRIBED IN THE APPENDIX. (A)

COMMENTS:

THIS PAPER IS CONCERNED WITH TRAINING INDIVIDUALS IN THE USE OF AN INTERACTIVE SYSTEM AND WITH MAKING THAT SYSTEM MORE RESPONSIVE TO THE UNIQUE REQUIREMENTS OF INDIVIDUAL USERS. THESE AREAS ARE ADDRESSED MORE AS BEHAVIORAL AND SOCIAL CONCERNS THAN AS PROBLEMS IN COMPUTER SCIENCE. THE TECHNIQUES AND PROCEDURES PROPOSED ARE STILL IN A DEVELOPMENTAL STAGE. AS SUCH, THIS PAPER FOCUSES PRIMARILY ON THE PROBLEMS THAT NEED TO BE CONSIDERED AND A STRATEGY FOR APPROACHING THESE PROBLEMS RATHER THAN ON PRACTICAL SOLUTIONS.

23 LARGE-SCREEN DISPLAYS BASED ON LASER-BEAM TECHNOLOGY
BAKER, C.E., & RUGARI, A.D. A LARGE-SCREEN REAL-TIME DISPLAY TECHNIQUE.
INFORMATION DISPLAY, MARCH/APRIL 1966, 3(2), Pp. 37-39; 42-46.
DESCRIPTION:

RAPID GROWTH IN COMPLEXITY OF COMMAND AND CONTROL SYSTEMS HAS PLACED SEVERE REQUIREMENTS ON ASSOCIATED DISPLAY SUBSYSTEMS. EXISTING DISPLAY TECHNOLOGY IS GENERALLY INADEQUATE, AND IT IS BECOMING INCREASINGLY DIFFICULT TO MEET THE OPERATIONAL REQUIREMENTS DICTATED BY PRESENT AND FUTURE SYSTEMS. CURRENT SYSTEMS CALL FOR DISPLAYS THAT CAN HANDLE LARGE VOLUMES OF DATA IN REAL TIME AND THAT ARE BRIGHT, IN FULL COLOR, OF HIGH RESOLUTION, AND HIGHLY FLEXIBLE. THERE ARE NO EXISTING DISPLAYS THAT CAN PROVIDE THIS TOTAL CAPABILITY. NEW TECHNIQUES MUST BE PROVIDED TO INSURE THAT THE DISPLAY DOES NOT BECOME THE WEAK LINK IN THE DATA PROCESSING CHAIN.

THE DEVELOPMENT OF THE LASER AS A PRACTICAL, CONTINUOUS, COHERENT LIGHT SOURCE HAS CREATED A NEW DISPLAY TECHNOLOGY, THAT OF THE LASER-BEAM DISPLAY. THIS PAPER IS PRIMARILY CONCERNED WITH THE DIRECT VIEW (VISIBLE) LASER DISPLAY. A FEASIBILITY MODEL OF A LASER DISPLAY IS DESCRIBED. (A, ABBR.) BP, BR.

COMMENTS:

THIS PAPER REVIEWS PROPERTIES OF LASERS, OPERATIONAL CONSIDERATIONS, AND THE COMPONENTS NEEDED TO DEVELOP A LASER DISPLAY. A PRELIMINARY MODEL OF SUCH A DISPLAY IS DESCRIBED AND VARIOUS PERFORMANCE CHARACTERISTICS ARE PRESENTED. ALTHOUGH THE FEASIBILITY OF MANUFACTURING SUCH DISPLAYS IS DEMONSTRATED, NO CONSIDERATION IS GIVEN TO HUMAN FACTORS ASPECTS OF LASER DISPLAYS.

24 MODELING OF INTERACTIVE SYSTEMS
BAKER, J.D. QUANTITATIVE MODELING OF HUMAN PERFORMANCE IN INFORMATION SYSTEMS.
ERGONOMICS, 1970, 13, 645-664. (NTIS NO. AD 746096)
DESCRIPTION:

THIS PAPER SUMMARIZES AN APPROACH TOWARD DEVELOPING A GENERAL INFORMATION SYSTEM MODEL WHICH FOCUSES ON MAN AND CONSIDERS THE COMPUTER ONLY AS A TOOL. THE ULTIMATE OBJECTIVE IS TO PRODUCE A SIMULATOR WHICH WILL YIELD MEASURES OF SYSTEM PERFORMANCE UNDER DIFFERENT MIXES OF EQUIPMENT, PERSONNEL, AND PROCEDURES. IN STRUCTURING THE FRAMEWORK FOR THIS MODEL, THE ASSUMPTION WAS MADE THAT MEN HAVE FIVE BASIC AND CRITICAL OPERATIONS TO PERFORM IN AN INFORMATION SYSTEM: SCREEN, TRANSFORM, INPUT, ASSIMILATE AND DECIDE. THESE OPERATIONS, OR FUNCTIONAL AREAS, ARE INTERRELATED ALONG THREE DIMENSIONS:
(1) A DATA FLOW AND PROCESSING DIMENSION; (2) A TASK ANALYSIS DIMENSION FOR EACH EVENT IN THE DATA FLOW SEQUENCE; AND (3) A SOURCE OF VARIATION DIMENSION, SUCH AS LEVEL OF TRAINING. THE MODEL APPROACH DESCRIBED HAS SEVERAL MAJOR POINTS OF PAYOFF. AMONG THE IMMEDIATE BENEFITS IS THE POTENTIAL FOR USING THE MODEL TO QUANTIFY HUMAN PERFORMANCE BY EMPLOYING SYSTEM MEASURES AND THE VALUE OF THE MODEL AS A TESTED USABLE TOOL FOR DEVELOPING TEST AND EVALUATION PLANS WHICH WILL PROVIDE HUMAN FACTORS DATA AS PART OF THE INFORMATION SYSTEM DESIGN VERIFICATION CHECKOUT. (A) 20P, 28R.

COMMENTS:

THIS PAPER PRESENTS A POTENTIALLY USEFUL APPROACH TO THE QUANTITATIVE MODELING OF INTERACTIVE PERFORMANCE AS A FUNCTION OF VARIATIONS IN SYSTEM DESIGN PARAMETERS, PERSONNEL, PROCEDURES, AND INPUT MIX. ALTHOUGH THE MODEL HAS BEEN IMPLEMENTED (SEE A.I. SIEGEL, J.J. WOLF, & W.R. LEAHY, 1973), THIS PAPER PREDATES THE IMPLEMENTATION AND CONTAINS ONLY THE CONCEPTUAL BASIS OF THE MODEL. SUCH MODELS APPEAR TO HOLD CONSIDERABLE LONG-TERM PROMISE FOR QUANTIFICATION OF THE TASK-RELATED AND PERSONNEL-RELATED ASPECTS OF INFORMATION SYSTEMS, BUT THE BENEFITS OF MODELING HAVE BEEN SLOW TO MATERIALIZE.

USEFULNESS OF POTENTIALLY RELEVANT INFORMATION IN MAN-COMPUTER DIALOGUE BAKER, J.D., & GOLDSTEIN, I. BATCH VS. SEQUENTIAL DISPLAYS: EFFECTS ON HUMAN PROBLEM SOLVING. HUMAN FACTORS, 1966, 8, 225-235.

DESCRIPTION:

THIS STUDY WAS CONCERNED WITH PROBLEM SOLVING UNDER TWO DISPLAY CONDITIONS. IN ONE CONDITION ("SEQUENTIAL"), ONLY THOSE RESPONSE ALTERNATIVES PERMISSABLE AT ANY GIVEN TIME WERE DISPLAYED AT THAT TIME. UNDER THE OTHER CONDITION ("BATCH"), ALL RESPONSE ALTERNATIVES, PERMISSABLE AT THE MOMENT OR NOT, WERE PRESENTED AT ALL TIMES. SIGNIFICANTLY GREATER TIME WAS FOUND TO BE REQUIRED TO LEARN SOLUTIONS USING THE "BATCH" DISPLAY. THIS REQUIREMENT WAS ATTRIBUTED TO THE SIGNIFICANTLY GREATER DISPLAY SEARCH-TIME WHICH WAS FOUND TO BE REQUIRED IN THAT CONDITION. NO SIGNIFICANT DIFFERENCE IN NUMBER OF TRIALS TO REACH THE CRITERION OF LEARNING SOLUTIONS WAS FOUND, INDICATING THAT THE ADDITIONAL MATERIAL DISPLAYED IN THE "BATCH" CONDITION CARRIES NO SIGNIFICANT AMOUNT OF USEFUL INFORMATION. IT IS CONCLUDED THAT DISPLAYING DATA WHICH HAS ONLY POTENTIAL RELEVANCE IS NOT ONLY INEFFECTIVE BUT ACTUALLY DEGRADES PERFORMANCE. (A)

# COMMENTS:

IT IS KNOWN THAT PRESENTATION OF IRRELEVANT INFORMATION ON DISPLAYS IMPEDES PERFORMANCE ON SOME (AND PROBABLY MOST) TASKS. THERE IS A GREY AREA, THOUGH: SHOULD INFORMATION BE DISPLAYED WHICH IS POTENTIALLY RELEVANT TO THE USER'S OVERALL TASK, BUT WHICH IS NOT RELEVANT AT THE TIME AT WHICH THE DISPLAY IS PRESENTED? THIS PAPER REPORTS AN EXPERIMENT INTENDED TO HELP ANSWER THIS QUESTION. THE STUDY IS WELL DONE AND WELL REPORTED, AND INDICATES THAT POTENTIALLY-BUT-NOT-CURRENTLY-RELEVANT INFORMATION SHOULD NOT BE DISPLAYED. THERE IS A METHODOLOGICAL LIMITATION OF THE STUDY WHICH PREVENTS ITS RESULTS FROM BEING CLEARLY GENERALIZABLE, HOWEVER. THE SUBJECT'S TASK INVOLVED LEARNING HIS WAY THROUGH A "MENTAL MAZE" OF NONSENSE THIS TASK HAS THE PROPERTY THAT POTENTIALLY-BUT-NOT-CURRENTLY-SYLLABLES. RELEVANT INFORMATION CANNOT NECESSARILY BE USEFULLY INTEGRATED BY THE PROBLEM SOLVER. EXPOSURE TO THIS INFORMATION MIGHT FAMILIARIZE THE USER WITH THE PARTICULAR NONSENSE SYLLABLES, BUT COULD NOT INDICATE PRECISELY HOW THEY ARE RELEVANT. IT COULD BE ARGUED THAT IN OTHER KINDS OF DISPLAYS, SUCH AS THOSE INVOLVING SELECTION FROM A LIST OF COMMANDS OR OPERANDS, CURRENTLY IRRELEVANT INFORMATION CAN BE USEFULLY INTEGRATED BY THE SUBJECT AND MIGHT THEREFORE FACILITATE LEARNING OF THE OVERALL COMMAND STRUCTURE. THUS, THE AUTHORS' CONCLUSION THAT PRESENTATION OF SUCH INFORMATION DOES NOT FACILITATE LEARNING MAY NOT BE WIDELY GENERALIZABLE. THE OBSERVED PERFORMANCE DEGRADATION DUE TO INCREASED VISUAL SEARCH TIME CAN BE EXPECTED EVEN IN SUCH TASKS AS COMMAND ENTRY, BUT PROBABLY DOES NOT PERSIST AFTER THE SUBJECT 15 THOROUGHLY FAMILIAR WITH THE SYSTEM.

26 MAN-COMPUTER PROBLEM SOLVING

BALDWIN, J.T., & SIKLOSSY, L. AN UNOBTRUSIVE COMPUTER MONITOR FOR MULTI-STEP PROBLEM SOLVING. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1977, 9, 349-362.

DESCRIPTION:

THIS PAPER DESCRIBES A PROCEDURAL MEANS FOR DESIGNING COMPUTER-ASSISTED INSTRUCTIONAL (CAI) SYSTEMS CALLED UNOBTRUSIVE PROBLEM SOLVING MONITORS (UPSM'S) WHICH: (1) MONITOR STUDENTS SOLVING MULTI-STEP PROBLEMS, AND (2) OFFER USEFUL, PERTINENT ADVICE TO THE STUDENT BASED ON THE PRIOR STUDENT INPUT HISTORY.

THESE SYSTEMS REPRESENT A CONCEPTUAL ADVANCE OVER EARLIER TYPES OF SYSTEMS IN THAT THEY ALLOW STUDENTS TO ENTER INTERMEDIATE RESULTS OF THEIR PROBLEM SOLVING ACTIVITY, YET ALSO ALLOW THEM TO DISCOVER AND CORNECT ANY ERRORS IN THESE RESULTS WITHOUT UNSOLICITED PROMPTING FROM THE SYSTEM. AT THE SAME TIME, THEY CAN OFFER SPECIFIC ADVICE GENERATED FROM A STUDENT'S INTERMEDIATE RESULTS WHENEVER REQUESTED. THESE FEATURES ALLOW STUDENTS TO OBTAIN THE BENEFITS OF PROBLEM SOLVING IN AN UNHINDERED, UNGUIDED FASHION, YET ALLOW THEM TO REQUEST HELP WHEN IT IS NEEDED.

THIS PAPER ALSO OUTLINES A PROTOTYPE UPSM SYSTEM THAT HAS BEEN IMPLEMENTED IN THE AREA OF PLANE GEOMETRY. THIS IMPLEMENTATION INCORPORATES A PROBLEM SOLVER THAT SOLVES PORTIONS OF THE PROBLEMS UNDER CONSIDERATION WHILE GENERATING STRUCTURED, VERBALIZED DESCRIPTIONS OF THE SOLUTION PROCESS WHICH ARE USED AS SOURCES OF INCREMENTAL ADVICE FOR THE STUDENT. BECAUSE THE PROBLEM SOLVER ATTEMPTS TO EXTEND LINES OF REASONING STARTED BY THE STUDENT, THE ADVICE THAT IS GENERATED ALLOWS THE GEOMETRY UPSM TO ADAPT ITS RESPONSES TO A VARIETY OF STUDENT INPUT HISTORIES. (A) 14P, 8R.

COMMENTS:

ALTHOUGH DESCRIBED IN TERMS OF A COMPUTER-ASSISTED INSTRUCTION (CAI) SYSTEM, THE SYSTEM DESCRIBED HERE CAN PROFITABLY BE VIEWED AS AN INTERACTIVE PROBLEM SOLVING SYSTEM. THIS SYSTEM IS SIMILAR TO THE SOPHIE SYSTEM (E.G., J.S. BROWN, R.R. BURTON, A.G. BELL, AND R.J. BUBROW, 1974) IN THAT IT PROVIDES A "REACTIVE" LEARNING ENVIRONMENT. THAT IS, THE STUDENT (OR USER) IS FREE TO EXPLORE IDEAS OR CREATE HYPOTHESES AND RECEIVE FEEDBACK AS TO THEIR VALIDITY. THE CURRENT SYSTEM DIFFERS FROM SOPHIE, AND OTHER SYSTEMS, IN THAT IT ALLOWS THE USER TO SPECIFY SUBGOALS, OR INTERMEDIATE STATES, AND IT SUGGESTS APPROPRIATE SUBGOALS AND DESCRIBES THE UNDERLYING PRINCIPLES. THESE FACETS CAN BE VERY USEFUL IN INTERACTIVE PROBLEM SOLVING SYSTEMS.

27 COMPUTERIZED PROBLEM-SOLVING AIDS

BALZER, R.M., & SHIREY, R.W. THE ON-LINE FIRING SQUAD SIMULATOR (TECHNICAL REPORT RM-5573-ARPA). SANTA MONICA, CALIFORNIA: RAND CORP., AUGUST 1968. (NITS NO. AD 675040)

DESCRIPTION:

THIS MEMORANDUM DESCRIBES A COMPUTER SYSTEM DESIGNED BOTH TO INVESTIGATE MAN/MACHINE GRAPHICAL COMMUNICATIONS AND TO FIND IMPROVED SOLUTIONS FOR THE FIRING SQUAD SYNCHRONIZATION PROBLEM. THE SYSTEM PROVIDES AIDS THAT ALLOW THE USER TO APPROACH THIS PROBLEM BY METHODS HE MIGHT OTHERWISE NOT ATTEMPT BECAUSE OF THE TEDIOUS HAND CALCULATIONS REQUIRED. FURTHERMORE, THE GRAPHICAL NATURE OF THE SYSTEM AND THE TYPE OF AIDS PROVIDED COMBINE TO INFLUENCE SIGNIFICANTLY THE ATTITUDE OF THE EXPERIMENTER TOWARD VARIOUS SOLUTION APPROACHES.

FIRST, THE AUTHORS STATE THE PROBLEM AND NOTE SOME OF ITS INHERENT DIFFICULTIES. NEXT, THEY DISCUSS THE NECESSARY TASKS FOR SOLVING THE PROBLEM, AND THEN GO ON TO SHOW HOW AND WHY SOME OF THESE TASKS SHOULD BE AUTOMATED. THEN, FINALLY, THE AUTHORS DISCUSS GENERAL PRINCIPLES LEARNED WHILE BUILDING THE SYSTEM, AND MAKE RECOMMENDATIONS CONCERNING THE COST AND ADVISABILITY OF CONSTRUCTING SIMILAR SYSTEMS. (A)

37P, 10R.

THIS PAPER ILLUSTRATES THE RELATIVE ADVANTAGES OF A GRAPHICAL, INTERACTIVE COMPUTER SYSTEM EVEN FOR THE SOLUTION OF PROBLEMS THAT ARE NOT INHERENTLY GRAPHICAL IN NATURE. MUCH OF THE USEFULNESS AND POWER OF THE SYSTEM DESCRIBED IN THIS PAPER APPEARS TO DERIVE FROM PROBLEM SOLVING AIDS. AIDS ARE INCLUDED TO STORE, ORGANIZE, AND DISPLAY RELEVANT INFORMATION, TO ALLOW RAPID TESTS OF PROPOSED SOLUTIONS, AND TO PROVIDE THE USER WITH THE CAPABILITY OF USING SOME HIGH-LEVEL, PROBLEM-SPECIFIC HEURISTICS. ALTHOUGH SUCH AIDS ARE DISCUSSED ONLY IN THE CONTEXT OF ONE SPECIFIC PROBLEM, SIMILAR AIDS COULD BE APPLIED IN A VARIETY OF SITUATIONS.

28 INTERACTIVE GRAPHICS, REVIEW

BARMACK, J.E., & SINAIKO, H.W. HUMAN FACTORS PROBLEMS IN COMPUTER-GENERATED GRAPHIC DISPLAYS (REPORT NO. S-234). ARLINGTON, VIRGINIA: INSTITUTE FOR DEFENSE ANALYSES, APRIL 1966. (NTIS NO. AD 636170) DESCRIPTION:

THIS PAPER REPORTS A REVIEW OF THE STATE OF THE ART WITH RESPECT TO HUMAN FACTORS AS APPLIED TO INTERACTIVE GRAPHICAL COMPUTER SYSTEMS. INFORMATION IN THE REPORT WAS DERIVED FROM BOTH A REVIEW OF THE LITERATURE AND VISITS TO 14 FACILITIES EMPLOYING SUCH SYSTEMS. THE REVIEW IS BROAD IN SCOPE, INCLUDING DISCUSSIONS OF: CRT DISPLAY PARAMETERS, DISPLAY CODING, DISPLAY FLICKER, THREE-DIMENSIONAL DISPLAYS, AND SYMBOLS; INPUT DEVICES, INCLUDING KEYBOARDS, CHARACTER AND SPEECH RECOGNITION, LIGHT PENS, AND SWITCHES; GENERAL SYSTEM PROPERTIES; AND A THEORETICAL DISCUSSION OF THE USE OF COMPUTERS TO ENHANCE CREATIVE EFFORT.

COMMENTS:

THIS IS AN EXCELLENT AND OFT-QUOTED GENERAL REVIEW OF THE HUMAN FACTORS ASPECTS OF GRAPHICAL SYSTEMS. IT CONTAINS A VERY NICE MIXTURE OF GUIDELINES AND EXAMPLES OF ACTUAL PRACTICE, AS WELL AS A FEW SUGGESTIONS FOR RESEARCH. IT IS NOT AS DATED AS ITS DATE WOULD SUGGEST; THERE ARE, OF COURSE, NEW TECHNOLOGICAL DEVELOPMENTS AND RESEARCH FINDINGS WHICH THE REPORT DOES NOT MENTION, BUT MOST OF WHAT IT DOES SAY REMAINS VALID TODAY. IT SHOULD BE OF INTEREST TO THOSE CONCERNED WITH GRAPHICAL SYSTEMS, AND POSSIBLY EVEN TO THOSE CONCERNED WITH NONGRAPHICAL TERMINALS.

29 RESPONSE TIME IN TIME-SHARING SYSTEMS
BARNEA, D.I., & ZIMMERMAN, S.I., A NOTE ON TIME-SHARING USERS (RESEARCH
REPORT RC-322B). YORKTOWN HEIGHTS, NEW YORK: IBM WATSON RESEARCH CENTER,
JANUARY 1971.
DESCRIPTION:

ON A TIME-SHARING SYSTEM, A USER'S HISTORY IS DIVIDED INTO AN ALTERNATING SEQUENCE OF USER INTERVALS AND SYSTEM INTERVALS. THE FORMER ARE THOSE DURING WHICH THE USER'S KEYBOARD IS UNLOCKED, THE LATTER THOSE DURING WHICH THE SYSTEM IS PROCESSING THE USER'S DEMANDS. FOR CERTAIN CONDITIONS, IT'S SHOWN THAT ONLY THE AVERAGE LENGTHS OF THESE INTERVALS ARE SIGNIFICANT AND NOT THEIR DISTRIBUTIONS. IN ADDITION, AN ALGEBRAIC INVESTIGATION OF DISTRIBUTION IS UNDERTAKEN. (A) 13P, 2R.

COMMENTS:

THIS PAPER PRESENTS A MATHEMATICAL TREATMENT OF THE RELATION BETWEEN 30TH SYSTEM AND USER RESPONSE TIMES AND THE WORK LOAD PLACED ON THE COMPUTER SYSTEM. BY MAKING ASSUMPTIONS ABOUT THE INDEPENDENCE OF THESE THREE VARIABLES, THE AUTHORS DEMONSTRATE THAT ONLY THE MEAN VALUES, AND NOT THE DISTRIBUTIONS, OF THESE VARIABLES ARE IMPORTANT. ALTHOUGH MATHEMATICALLY CORRECT, THIS ARGUMENT IS, ON PSYCHOLOGICAL GROUNDS, UNTENABLE. FOR EXAMPLE, J.R. CARBONELL, J.I. ELKIND, AND R.S. NICKERSON (1968) DEMONSTRATED THAT VARIABILITY IN SYSTEM RESPONSE TIME CAN SERIOUSLY EFFECT USER PERFORMANCE, AND HENCE, BOTH USER RESPONSE TIME AND THE DEMAND FOR COMPUTER RESOURCES. MATHEMATICAL DESCRIPTIONS AND ANALYSES OF INTERACTIVE SYSTEMS COULD BE VERY USEFUL. CARE MUST BE TAKEN, HOWEVER, TO INCLUDE A VIABLE MODEL OF THE USER IN SUCH ANALYSES.

FUNCTIONAL PROPERTIES OF COMPUTER TERMINALS

BARON, R., & DUFFY, W.J. INFORMATION DISPLAY SPEED AND NOISE IN THE DESIGN OF
COMPUTER TERMINALS. IN PROCEEDINGS OF THE HUMAN FACTORS SOCIETY 18TH ANNUAL
MEETING. SANTA MONICA, CALIFORNIA; HUMAN FACTORS SOCIETY, 1974, 42-45.
DESCRIPTION:

THE VARIETY OF COMPUTER TERMINALS IS GROWING RAPIDLY. RESEARCH ON VARIABLES LIKELY TO HAVE THE GREATEST EFFECT ON OPERATOR-TERMINAL INTERACTION IS NEEDED TO GUIDE TERMINAL DESIGN. EFFECTIVE INFORMATION ON DISPLAY RATES FOR THE MOST COMMON TASKS PERFORMED AT A TERMINAL (E.G., PROGRAM DEBUGGING, TYPING) HAVE NOT BEEN REPORTED IN THE LITERATURE. THIS PAPER INVESTIGATES THE VARIABLES OF TERMINAL TYPES, DISPLAY SPEED AND DISPLAY NOISE SINCE THESE DETERMINE TO A LARGE EXTENT THE COST OF TERMINALS. THE RESULTS SHOW A STRONG EFFECT DUE TO DISPLAY SPEED WITH VIRTUALLY NO EFFECT DUE TO DISPLAY NOISE AND TERMINAL TYPE. OPERATOR RESPONSE SPEED FOR THE DEBUGGING TASK INCREASED UP TO A SPEED OF ABOUT 60 CPS WITH NO FURTHER ADVANTAGE GAINED AT HIGHER SPEEDS (UP TO 240 CPS). (A)

COMMENTS:

THIS IS A HIGHLY QUESTIONABLE STUDY. THE "DEBUGGING" TASK HAS LITTLE TO DO WITH ACTUAL SOFTWARE DEBUGGING, BUT IS INSTEAD A VISUAL SEARCH FOR A RANDOM SINGLE-CHARACTER SUBSTITUTION IN A ONE-LINE FORTRAN STATEMENT. THIS IS ESSENTIALLY S.L. SMITH AND N.C. GOODWIN'S (1973) CHECK-READING TASK, ORIGINALLY INTENDED AS A METHOD FOR MEASURING DISPLAY LEGIBILITY. HERE, THOUGH, IT IS USED TO MEASURE THE EFFECTS OF DISPLAY SPEED. THE PROBLEM IS THAT THIS IS SUCH A SIMPLE TASK THAT HUMAN FACTORS CONSIDERATIONS VIRTUALLY WASH OUT, LEAVING RESULTS WHICH APPEAR TO BE FULLY EXPLAINABLE ON THE BASIS OF THE DELAY BETWEEN THE START OF A DISPLAY TRANSMISSION AND THE DISPLAY OF THE ERRONEOUS CHARACTER. THAT WOULD BE FINE, AND WOULD YIELD USEFUL RESULTS, IF THERE WERE REAL TASKS, OTHER THAN SINGLE LINE CHECK-READING, WHICH HAD SIMILAR PROPERTIES. IT IS DIFFICULT TO THINK OF ANY, HOWEVER, AND THE AUTHORS' CONCLUSIONS CONCERNING AVAILABLE DISPLAY RATES SHOULD NOT BE GENERALIZED TO TASKS OF A VERY DIFFERENT NATURE. WHAT IS USEFUL IN THIS STUDY IS THE FACT THAT IT SUGGESTS A KIND OF COMPARATIVE EXPERIMENT WHICH COULD BE EMPLOYED TO SELECT TERMINALS USING THE ACTUAL TASK FOR WHICH THE TERMINALS WILL EVENTUALLY BE USED. THE PAPER HAS LITTLE TO CONTRIBUTE TO THOSE INTERESTED IN THE PROPERTIES THAT TERMINALS SHOULD HAVE, BUT MAY BE SUGGESTIVE FOR THOSE WHO WISH TO CONDUCT THEIR OWN EXPERIMENTAL EVALUATIONS OF ALTERNATIVE TERMINALS.

SYSTEM EVALUATION BY QUESTIONNAIRE AND INTERVIEW
BARRETT, G.V., THORNTON, C.L., & CABE, P.A. HUMAN FACTORS EVALUATION OF A
COMPUTER BASED INFORMATION STORAGE AND RETRIEVAL SYSTEM. HUMAN FACTORS, 1968,
10, 431-436.
DESCRIPTION:

THE HUMAN FACTORS ASPECTS OF A COMPUTER-BASED INFORMATION STORAGE AND RETRIEVAL SYSTEM WERE EVALUATED IN THREE GOVERNMENT INTELLIGENCE SERVICES USING QUESTIONNAIRE AND INTERWIEW TECHNIQUES. IT WAS FOUND THAT MANY FACTORS ENTERED INTO SATISFACTION WITH THE INFORMATION SYSTEM, INCLUDING FAMILIARITY, EASE OF USE, AND IMPORTANCE. OTHER RELEVANT FACTORS INCLUDED TRAINING IN THE USE OF THE SYSTEM, AMOUNT AND TYPE OF INFORMATION TO MEET NEEDS IN THE SYSTEM, AND TOLERANCES OF INDIVIDUALS FOR IRRELEVANT MATERIAL IN THE OUTFUT OF SEARCHES. THE INTERACTION OF THESE FACTORS IS DISCUSSED IN RELATION TO SATISFACTION WITH THE SYSTEM. (A)

COMMENTS:

QUESTIONNAIRE AND INTERVIEW TECHNIQUES FOR SYSTEM EVALUATION HAVE THE ADVANTAGE THAT THEY ARE FAIRLY UNIVERSALLY APPLICABLE. THEY HAVE THE DISADVANTAGE THAT THEY MEASURE PRIMARILY USER SATISFACTION, BUT USUALLY GIVE LITTLE INSIGHT INTO SYSTEM PERFORMANCE. UNFORTUNATELY, USER SATISFACTION AND PERFORMANCE ARE OFTEN LOOSELY, AND SOMETIMES NEGATIVELY, RELATED. THIS PAPER REPRESENTS ONE OF THE BETTER QUESTIONNAIRE-BASED SYSTEM EVALUATIONS, AND DESCRIBES THE KINDS OF QUESTIONNAIRE ITEMS USED IN ALMOST ENOUGH DETAIL TO ALLOW THE READER TO APPLY THE TECHNIQUE HIMSELF. AS LONG AS THE LIMITATIONS OF THIS APPROACH TO SYSTEM EVALUATION ARE KEPT IN MIND, THE APPROACH IS USEFUL.

32 INTERACTIVE AIDS FOR RESOURCE ALLOCATION PROBLEMS
BATTERSBY, A., & BERNERS-LEE, M.L. COMMUNICATION THROUGH INTERACTIVE
DIAGRAMS. IN R.E. GREEN & R.D. PARSLOW (EDS.), COMPUTER GRAPHICS IN
MANAGEMENT. LONDON: GOWER, 1970, 68-84.
DESCRIPTION:

THIS PAPER DESCRIBES THE BACKGROUND AND IMPLEMENTATION OF A PROJECT WHOSE OBJECT WAS TO FURTHER UNDERSTANDING OF THE BASIC PRINCIPLES OF THE DESIGN OF DISPLAY SYSTEMS FROM THE POINT OF VIEW OF THE DISPLAY USER'S VISUAL PSYCHOLOGY. IT HAS ALSO PROVIDED AN EFFECTIVE MEANS FOR TEACHING THE PRINCIPLES OF RESOURCE MANAGEMENT.

THE APPROACH ADOPTED HAS BEEN TO DESIGN AND IMPLEMENT A SYSTEM FOR INTERACTIVE SOLUTION OF A SCHEDULING PROBLEM WHICH, THOUGH SMALL ENOUGH FOR VISUAL PRESENTATION, IS NON-TRIVIAL AND SIMILAR TO A NUMBER OF INDUSTRIAL MANAGEMENT PLANNING PROBLEMS. A SUBJECT USING THE SYSTEM CAN BE PRESENTED WITH THE SAME PROBLEM IN DIFFERENT WAYS AND HIS PROBLEM SOLVING EFFICIENCY COMPARED FROM THE OUTPUT RECORD OF TIMES, NUMBERS OF MOVES MADE AND FINAL RESOURCE UTILIZATION ACHIEVED.

THE PROBLEMS OF SYSTEM DESIGN AND PROGRAM DEVELOPMENT FOR DISPLAY WORK WILL BE DISCUSSED. (A)

17P, 10R.

THE AUTHORS SUGGEST AN INTERESTING TECHNIQUE FOR FACILITATING PERFORMANCE IN A RESOURCE ALLOCATION TASK. THIS TECHNIQUE EMPLOYS A PATTERN REPRESENTATION FORMAT THAT IS ISOMORPHIC (APPARENTLY DIFFERENT BUT LOGICALLY IDENTICAL) TO THE MORE STANDARD PERT-TYPE NETWORK. THIS PAPER, HOWEVER, FOCUSES ON THE IMPLEMENTATION OF THIS TECHNIQUE IN AN INTERACTIVE SYSTEM RATHER THAN ON EMPIRICAL TESTS OF THIS TECHNIQUE. THE USEFULNESS OF THIS TECHNIQUE, HOWEVER, HAS BEEN DEMONSTRATED BY H.T. SMITH (1974).

COMPUTER-AIDED ARCHITECTURAL DESIGN
BAZJANAC, V. THE PROMISES AND THE DISAPPOINTMENTS OF COMPUTER-AIDED DESIGN.
IN N. NEGROPONTE (ED.), REFLECTIONS ON COMPUTER AIDS TO DESIGN AND ARCHITECTURE.
NEW YORK: PETROCELLI/CHARTER, 1975, 17-26.
DESCRIPTION:

THE PRINCIPAL REASONS FOR SIGNIFICANT INTEREST IN COMPUTER-AIDED DESIGN IN ARCHITECTURE ARE THE PROMISES THAT THIS CONCEPT IMPLIES. THESE PROMISES ARE THAT SUCH AIDS WILL FREE THE DESIGNER FROM DISTRACTING AND UNPRODUCTIVE ACTIVITIES AND ALLOW HIM TO DEVOTE MORE TIME TO DESIGN, THAT THE DESIGNER WILL BE ABLE TO PREDICT PERFORMANCE OF ANY DESIGN ALTERNATIVE HE MAY GENERATE, AND THAT ACCUMULATED EXPERIENCES WILL BE INSTANTANEOUSLY AVAILABLE. THE LACK OF SUCCESS OF COMPUTER-AIDED DESIGN IS DUE TO MISCONCEPTIONS ABOUT HOW DESIGN IS ACTUALLY DONE; PRINCIPALLY THAT FORMAL MODELS OF THE DESIGN PROCESS CAN BE EXTRACTED. IT IS ARGUED THAT DESIGN AIDS INCREASE, RATHER THAN REDUCE. RESOURCE DEMANDS ON THE DESIGNER AND THAT ADDING RESOURCES WILL NOT IMPROVE THE QUALITY OF DESIGNS.

COMMENTS:

THE AUTHOR OF THIS PAPER EXPRESSES CONSIDERABLE DISAPPOINTMENT WITH WHAT HAS BEEN ACHIEVED IN THE AREA OF COMPUTER-AIDED ARCHITECTURAL DESIGN AND DRAWS THE HIGHLY PESSIMISTIC CONCLUSION THAT SIGNIFICANT ACCOMPLISHMENTS IN THIS AREA ARE IMPOSSIBLE IN PRINCIPLE. AS HE POINTS OUT, MANY PAST EFFORTS HAVE BEEN CHARACTERIZED BY A LACK OF ATTENTION TO THE NATURE OF THE DESIGN PROCESS ITSELF. THE EXAMPLES CITED IN THE PAPER SEEM TO JUSTIFY AT LEAST THE CONCLUSION THAT SOME ASPECTS OF THE DESIGN PROCESS ARE INAPPROPRIATE FOR AUTOMATED AIDS (E.G., AUTOMATION OF THE BEHAVIOR OF A HIGHLY COMPETENT, EXPERIENCED COST ESTIMATOR). WHETHER OR NOT THE AUTHOR'S MORE GLOBAL PESSIMISM IS JUSTIFIED IS ARGUABLE. IN ANY EVENT, THE PAPER POINTS OUT A NUMBER OF STUMBLING BLOCKS WHICH HAVE BEEN ENCOUNTERED IN COMPUTER-AIDED DESIGN, AND IT SHOULD BE OF INTEREST TO THE AUTOMATED-DECISION-AID COMMUNITY AS A WHOLE.

PHYSICAL PROPERTIES OF CRT TERMINALS

BEDFORD, A.D. CRT CONSIDERATIONS IN DATA TERMINAL DESIGN. COMPUTER

DESIGN, FEBRUARY 1975, PP. 84-87.

DESCRIPTION:

CERTAIN OPTIONS AND CONSTRAINTS ARE CRITICAL TO A SUCCESSFUL MARRIAGE OF DIGITAL AND VIDEO TECHNOLOGIES. THIS NOTE INTRODUCES SOME OF THE IMPORTANT ASPECTS OF VIDEO CIRCUITRY, ESPECIALLY AS THEY RELATE TO VIDEO OPERATION IN THE DIGITAL ENVIRONMENT. (A) 4P, OR.

COMMENTS:

THIS PAPER DEFINES CERTAIN CONCEPTS THAT A TERMINAL DESIGNER SHOULD CONSIDER WHEN SELECTING A CRT DISPLAY. SOME OF THE CONCEPTS DISCUSSED ARE: SCAN METHOD, RESOLUTION, FLUX PRECAUTION, CHARACTER DISPLAY, AND PHOSPHORS. COMMONLY USED VALUES FOR SUCH PARAMETERS ARE ALSO PRESENTED. THE VALUES ARE NEITHER JUSTIFIED IN THE REPORT NOR RELATED TO HUMAN FACTORS CRITERIA.

35 HUMAN ERRORS IN COMPUTER SYSTEMS
BELL TELEPHONE LABORATORIES, INC. HUMAN ERROR IN COMPUTER-BASED DATA
PROCESSING SYSTEMS. HOLMOEL, NEW JERSEY: BELL TELEPHONE LABORATORIES, INC.,
HUMAN PERFORMANCE TECHNOLOGY CENTER, 1973.
DESCRIPTION:

THIS PAPER ASSERTS THAT THE CAPACITY OF THE HUMAN TO MAKE ERRORS IS THE SINGLE MOST SIGNIFICANT DETERRENT TO SUCCESSFUL SYSTEM OPERATION. BEGINNING WITH THIS PREMISE, THE PAPER DEFINES ERRORS AND DISCUSSES THE PROBLEMS AND COSTS ASSOCIATED WITH ERRORS. THE PRINCIPAL TOPICS CONSIDERED ARE ERROR SOURCES, METHODS OF REPORTING ON ERRORS, ERROR CAUSES AND TECHNIQUES FOR CONTROLLING ERRORS.

54P, OR.

COMMENTS:

THIS PAPER PROVIDES AN EXCELLENT INTRODUCTION TO THE AREA OF HUMAN ERRORS IN COMPUTERIZED SYSTEMS. THE AUTHOR BEGINS WITH THE ASSUMPTION THAT "THE CAPACITY OF THE HUMAN TO MAKE ERRORS IS THE SINGLE MOST SIGNIFICANT DÉTERRENT TO SUCCESSFUL SYSTEM OPERATION" AND THAT "MANY ERRORS MADE WHILE OPERATING A SYSTEM CAN BE RELATED BACK TO FAULTY DESIGN DECISIONS MADE DURING SYSTEM DEVELOPMENT." THIS UNDERSCORES THE NECESSITY FOR CONSIDERING THE MAN-COMPUTER INTERFACE EARLY IN THE SYSTEM DESIGN PROCESS. ALTHOUGH THIS PAPER CONCENTRATES ON HUMAN ERRORS IN THE BELL TELEPHONE SYSTEM, THE DISCUSSIONS OF ERROR SOURCES, CAUSES, AND CONTROL COULD BE APPLICABLE TO ALMOST ANY TASK ENVIRONMENT.

36 USE OF SPATIAL CONCEPTS IN MAN-COMPUTER DIALOGUE
BENNETT, J.L. SPATIAL CONCEPTS AS AN ORGANIZING PRINCIPLE FOR INTERACTIVE
BIBLIOGRAPHIC SEARCH. IN D.E. WALKER (ED.), INTERACTIVE BIBLIOGRAPHIC
SEARCH: THE USER/COMPUTER INTERFACE. MONTVALE, NJ: AFIPS PRESS, 1971,
67-82.

DESCRIPTION:

THE PURPOSE OF THIS PAPER IS TO DISCUSS THE ROLE A SPATIAL FRAMEWORK OF USER WORKSPACES AND SYSTEM FILES CAN PLAY IN HELPING A USER TO ORGANIZE HIS SEARCH STRATEGY. THE PAPER IS BASED ON EXPERIENCE IN DESIGNING AND USING THE NEGOTIATED SEARCH FACILITY, A TOOL FOR PROVIDING INTERACTIVE, ON-LINE ACCESS TO BIBLIOGRAPHIC REFERENCES. (A) 16P, 9R.

COMMENTS:

THE USEFULNESS OF AN INFORMATION RETRIEVAL SYSTEM IS DIRECTLY RELATED TO THE ABILITY OF THE USER TO ADEQUATELY DEFINE HIS INFORMATION NEEDS. USERS GENERALLY BEGIN WITH RELATIVELY INFORMAL SEARCH STRATEGIES AND SUCCESSIVELY REFORMULATE THESE STRATEGIES AS THEY RECEIVE FEEDBACK FROM THE SYSTEM. THIS PAPER FOCUSES ON DESIGNING A SYSTEM TO AID IN THIS PROCESS. THE THESIS OF THIS PAPER IS THAT INFORMATION RETRIEVAL CAN BE DECOMPOSED INTO FIVE FUNCTIONS AND THAT A SEPARATE DISPLAY, OR DISPLAY FORMAT, SHOULD BE USED FOR EACH OF THESE AREAS. PARTITIONING THE SEARCH TASK INTO SIMPLER SUBTASKS SHOULD IMPROVE PERFORMANCE, PROVIDED THAT THESE SUBTASKS ARE RELATIVELY INDEPENDENT AND THE USER PERCEIVES THESE SUBTASKS AS COHERENT TASKS. ALTHOUGH THE PARTITION PROPOSED IN THIS PAPER MAY BE REASONABLE, ADDITIONAL RESEARCH SHOULD BE CONDUCTED TO DETERMINE ITS APPROPRIATENESS. THIS PAPER WOULD BE RELEVANT TO THOSE INTERESTED IN BIBLIORAPHIC SEARCH SYSTEMS OR IN TECHNIQUES FOR ACCESSING LARGE, INDEXED DATA BASES.

37 MAN-COMPUTER INTERFACES, REVIEW
BENNETT, J.L. THE USER INTERFACE IN INTERACTIVE SYSTEMS. IN C.A. CAUDRA
(ED.), ANNUAL REVIEW OF INFORMATION SCIENCE AND TECHNOLOGY (VOL. 7).
WASHINGTON, D.C.: AMERICAN SOCIETY FOR INFORMATION SCIENCE, 1972, 159-196.
DESCRIPTION:

WE ARE ENTERING AN ERA IN WHICH A LARGE NUMBER OF PEOPLE WHO ARE NOT COMPUTER SCIENTISTS WILL BE ABLE TO USE INTERACITVE TERMINALS AS PROBLEM-SOLVING TOOLS. IT IS BECOMING INCREASINGLY IMPORTANT TO COMSIDER USER BEHAVIOR PATTERNS IN INTERFACE DESIGN. THIS PAPER REVIEWS THE SYNTHESIS OF AN INTERACTIVE FACILITY, SYSTEM REDEVELOPMENT, AND DEVELOPMENTS INFLUENCING THE DESIGN OF INTERACTIVE FACILITIES. THE DISCUSSION CONCLUDES WITH SUGGESTIONS FOR FUTURE DEVELOPMENTS IN USER INTERFACE TECHNOLOGY.

COMMENTS:

AS THE AUTHOR NOTES, EARLIER "ANNUAL REVIEW" CHAPTERS ON MAN-COMPUTER INTERACTION FOCUSED PRIMARILY ON INTERACTIVE PROGRAMMING, SOFTWARE TECHNIQUES FOR TIME-SHARING, AND COMPUTER-RELATED ASPECTS OF THE INTERFACE. THIS PAPER IS THE FIRST SUCH REVIEW TO FOCUS ON THE USER SIDE OF THE INTERFACE. GUIDELINES FOR THE DEVELOPMENT OF EFFECTIVE INTERACTIVE SYSTEMS ARE PROPOSED. THIS PAPER, AND OTHER ANNUAL REVIEWS, WOULD BE USEFUL TO ANYONE WISHING AN INTRODUCTION TO THE AREA OF MAN-COMPUTER INTERACTION OR THOSE INTERESTED IN FOLLOWING THE DEVELOPMENT OF ISSUES AND VIEWPOINTS IN THIS AREA.

BEASE OF USE OF BIBLIOGRAPHIC SEARCH SYSTEMS
BENNETT, J.L. EASE OF USE AS AN ACCEPTANCE FACTOR IN INTERACTIVE SEARCH
SYSTEMS. IN INTERACTIVE BIBLIOGRAPHIC SYSTEMS: PROCEEDINGS OF A FORUM HELD
AT GAITHERSBURG, MD, OCTOBER 1971. WASHINGTON, D.C.: U.S. ATOMIC ENERGY
COMMISSION OFFICE OF INFORMATION SERVICES, 1973, 163-174.
DESCRIPTION:

A SUCCESSFUL INTERACTIVE SEARCH SYSTEM MUST RESPOND TO THE KEY CHARACTERISTICS OF COMPLEX SEARCH; THAT IS, THE SEARCHER WILL RECOGNIZE INFORMATION WHEN HE SEES IT IN THE CONTEXT OF DATA EVEN THOUGH HE CANNOT DESCRIBE THE TARGET ACCURATELY IN ADVANCE AND THOUGH HE IS NOT CERTAIN IN ADVANCE WHICH SEARCH PATH WILL LEAD TO DESIRED INFORMATION. IF WE PROVIDE THE SEARCH POWER TO SUPPORT NEGOTIATION, WE MUST CONSIDER THE IMPACT ON PERCEIVED EASE OF USE RESULTING FROM THE REQUIREMENT THAT THE SEARCHER BE RESPONSIBLE FOR SEARCH DECISIONS. THE TRADE-OFF BALANCE BETWEEN EASE OF USE AND SEARCH POWER WILL BE AFFECTED BY DEVELOPMENT TAKING FORM NOW IN SEARCH SYSTEM DESIGN AND IN THE CULTURAL IMPACT OF COMPUTERS. THESE DEVELOPMENTS CAN BE EXPLOITED TO PROVIDE SEARCH SYSTEMS JUDGED TO BE EASY TO USE WITHOUT SACRIFICE IN SEARCH POWER. (A) 12P, 14R.

COMMENTS:

IT IS VERY DIFFICULT TO DEFINE GUIDELINES FOR ACHIEVING EASE OF USE.
UNLIKE MEASURES SUCH AS SYSTEM RESPONSE TIME, EASE OF USE CANNOT EASILY BE
QUANTIFIED. IN ADDITION, THE USER'S PERCEPTION OF EASE OF USE WILL
PROBABLY CHANGE AS HE GAINS FAMILIARITY WITH THE SYSTEM. EVEN THOUGH THIS
CONCEPT MAY NOT BE WELL-DEFINED, IT IS OBVIOUSLY AN IMPORTANT FACTOR IN
USER ACCEPTANCE. THIS PAPER PRESENTS AN UNDETAILED, READABLE DISCUSSION OF
FACTORS THAT AFFECT PERCEIVED EASE OF USE. ALTHOUGH THE AUTHOR DOES NOT
PRESENT GUIDELINES FOR SYSTEM DESIGN, HE DOES IDENTIFY AREAS THAT SHOULD BE
CONSIDERED.

39 USER REQUIREMENTS ANALYSIS FOR MANAGEMENT INFORMATION SYSTEMS BENTLEY, T.J. DEFINING MANAGEMENT'S INFORMATION NEEDS. AFIPS CONFERENCE PROCEEDINGS, 1976, 45, 869-876.
DESCRIPTION:

BEFORE WE CAN DISCUSS MANAGEMENT INFORMATION SYSTEMS ON A COHERENT AND BENEFICIAL LEVEL WE MUST KNOW THE NEEDS OF THOSE AT WHOM THE INFORMATION IS DIRECTED. IT HAS BEEN SAID THAT A GOOD SALESMAN CAN CREATE NEEDS FOR HIS PRODUCT AND THERE IS NO DOUBT THAT THIS IS WHAT HAS HAPPENED IN THE DEVELOPMENT OF COMPUTER BASED SYSTEMS. IT IS TIME WE FOUND OUT WHAT OUR CUSTOMERS' REAL NEEDS ARE AND IT IS TIME THAT WE ADMITTED TO OURSELVES THAT THESE NEEDS MAY NOT ALWAYS REQUIRE THE MOST SOPHISTICATED SOLUTION.

THIS PAPER DESCRIBES A SURVEY WHICH SETS OUT TO ESTABLISH MANAGEMENT'S INFORMATION NEEDS BY FOCUSSING ON THE DECISIONS TAKEN BY MANAGERS AND THE INFORMATION NECESSARY TO PROVIDE THE INPUT FOR THE DECISION PROCESS. THIS IDENTIFICATION OF DECISION POINTS AND THE SUBSEQUENT ANALYSIS OF INFORMATION NEEDS IS AN ESSENTIAL PREREQUISITE FOR THE SUCCESSFUL DESIGN OF MEANINGFUL INFORMATION SYSTEMS. THE STEPS TO BE TAKEN ARE SET OUT IN DETAIL TOGETHER WITH MY COMMENTS BASED ON THE PRACTICAL EXPERIENCE OF CARRYING OUT SUCH AN ANALYSIS. (A) BP, BR.

COMMENTS:

THIS IS ONE OF A NUMBER OF PAPERS WHICH ATTEMPT TO DEVISE METHODS FOR DETERMINING AND STRUCTURING THE INFORMATION REQUIREMENTS OF MANAGERS, IN ORDER TO ASSIST IN THE DEVELOPMENT OF BETTER MANAGEMENT INFORMATION SYSTEMS. IN THE PROCEDURE ADVOCATED HERE, A MANAGER IS ASSISTED BY A SYSTEMS ANALYST IN DEFINING THE DECISIONS WHICH ARE MADE BY THE MANAGER AND CLASSIFYING THEM ALONG SEVERAL DIMENSIONS. ALTHOUGH SUCH A PROCEDURE PROVIDES AN EASY-TO-USE CHECKLIST OF INFORMATION REQUIREMENTS, THE RESULTING ANALYSIS MAY VERY WELL BE MISLEADING. SUCCESSFUL APPLICATION OF THE METHOD WOULD REQUIRE A MANAGER WHO HAS GREAT INSIGHT INTO HIS DECISION MAKING AND INFORMATION NEEDS, AND CAN VERBALIZE THEM, OR AN EXTREMELY INSIGHTFUL ANALYST, OR BOTH. EITHER IS EXTREMELY RARE. MOREOVER, THE PROCEDURE ASSUMES THAT THE MANAGER'S FUTURE INFORMATION NEEDS ARE SUSCEPTIBLE TO SUCH ANALYSIS. IF K.D. EASON (1976) IS CORRECT, ONE OF THE PRINCIPAL FEATURES WHICH MAKES MANAGERS DIFFICULT CUSTOMERS FOR INFORMATION SYSTEMS IS THE HIGHLY VARIABLE NATURE OF THEIR DECISION SITUATIONS AND INFORMATION REQUIREMENTS. IT MAY ALSO BE THAT MANAGERS DIFFER CONSIDERABLY IN THEIR INFORMATION NEEDS (SEE STRUB, M.H., AND LEVIT, R.A., 1974), IN WHICH CASE EXTRAPOLATION FROM SUCH AN ANALYSIS TO ALL EVENTUAL USERS OF AN MIS WOULD BE DIFFICULT. THE PROBLEMS WHICH T THE PROBLEMS WHICH THIS PAPER ADDRESSES ARE REAL AND IMPORTANT AND THE AUTHOR'S APPROACH IS NOT ENTIRELY WITHOUT MERIT. HOWEVER, UNTIL WE HAVE A GREATER UNDERSTANDING OF THE MANAGEMENT DECISION MAKING PROCESS ITSELF, IT MAY BE THAT WE SHOULD CONCENTRATE MORE ON THE DEVELOPMENT OF GENERAL DATA BASE MANAGEMENT AND QUERY SYSTEMS AND LESS ON THE ANALYSIS OF THE EXPRESSED INFORMATION REQUIREMENTS OF INDIVIDUAL MANAGERS.

40 MAN-COMPUTER DIALOGUE
BERKELEY, E.C. MAN/COMPUTER INTERFACE (EDITORIAL). COMPUTERS AND AUTOMATION, MAY 1966, 15, 7.
DESCRIPTION:

PEOPLE AND MACHINES HAVE VERY DIFFERENT EQUIPMENT FOR PROCESSING INFORMATION. THIS IMPLIES THAT IT MAY BE DIFFICULT TO CHANGE OPERATIONS AND OPERATING PROCEDURES FROM A LANGUAGE AND BEHAVIOR WHICH A HUMAN UNDERSTANDS INTO A LANGUAGE AND BEHAVIOR WHICH A COMPUTER UNDERSTANDS. WHAT IS NEEDED IS SOMETHING LIKE ROGET'S THESAURUS FOR TRANSLATING HUMAN IDEAS INTO COMPUTER LANGUAGE.

1P. DR.

THIS IS A VERY BRIEF EDITORIAL. THE THESIS IS THAT IT IS DIFFICULT TO TRANSLATE CONCEPTS FROM A HUMAN-UNDERSTANDABLE FORM TO A COMPUTER-UNDERSTANDABLE FORM. IT IS VERY DIFFICULT TO REFUTE THIS IDEA. THE ESSENTIAL QUESTION IS HOW CAN THIS TRANSLATION PROCESS BE AIDED. THE SOLUTION PROPOSED HERE, THAT COMPUTER PROGRAM EQUIVALENTS FOR NATURAL LANGUAGE CONCEPTS BE CONSTRUCTED, MAY HAVE SOME MERIT, BUT APPEARS, ON THE WHOLE, TO BE IMPRACTICAL.

41 AUTOMATED SPEECH RECOGNITION

BEZDEL, W. SOME PROBLEMS IN MAN-MACHINE COMMUNICATION USING SPEECH. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1970, 2, 157-168. DESCRIPTION:

THE PERFORMANCE OF OPERATORS, ESPECIALLY IN TERMS OF TRANSMISSION RATE AND THE EFFECTS OF VARIOUS TYPES OF ERRORS, IN USING A MAN-MACHINE SPEECH-COMMUNICATION LINK IS REPORTED. AN ABBREVIATED DESCRIPTION IS ALSO GIVEN OF THE WORD RECOGNIZER AND OF THE RESULTS OF TESTS WITH 30 REFERENCE AND 12 UNKNOWN TALKERS, AND USING A LIMITED VOCABILARY CONSISTING MAINLY OF DIGITS. (A)

12P, 2R.

THIS PAPER CONSIDERS THE QUESTION OF WHAT ARE THE RELEVANT HUMAN FACTORS PROBLEMS IN CONSTRUCTING A MAN-MACHINE SPEECH-COMMUNICATION LINK AND DESCRIBES A FAIRLY ACCURATE WORD RECOGNITION SYSTEM. THE AUTHOR NOTES THAT IT IS THE EXTREME VARIABILITY IN HUMAN SPEECH WHICH LIMITS EFFECTIVE MAN-MACHINE SPEECH COMMUNICATION. A LATER REVIEW BY R. TURN (1974) SUGGESTS THAT THIS REMAINS THE PRINCIPAL UNSOLVED PROBLEM IN THIS AREA. THIS PAPER HIGHLIGHTS BOTH THE NECESSITY OF ACHIEVING A NATURAL FORM OF MAN-MACHINE COMMUNICATION AND THE DIFFICULTY OF ACHIEVING THIS OBJECTIVE. THE AUTHOR ALSO PRESENTS DATA ON OVERALL ERROR RATE, SPEED OF TRANSMISSION, OPERATOR FATIGUE, AND THE CONVENIENCE OF USING THE PROPOSED SYSTEM. ALTHOUGH THESE DATA MAY GIVE THE READER A GENERAL DESCRIPTION OF VARIOUS SPEECH CHARACTERISTICS, THEY ARE NOT PRESENTED IN A MANNER WHICH WOULD ALLOW FOR THEIR USE BY OTHER RESEARCHERS IN THIS AREA.

42 DISPLAYS

BIBERMAN, L.M. (ED.) PERCEPTION OF DISPLAYED INFORMATION. NEW YORK: PLENUM PRESS, 1973.

DESCRIPTION:

A UNIVERSAL CRITICISM OF REVIEWS OF THE LITERATURE ON DISPLAY CHARACTERISTICS AND DESIGN IS THAT THERE IS LOTS OF HARDWARE INFORMATION, BUT NO CRITERIA UPON WHICH ONE COULD BASE A SOUND DESIGN. THOUGH ONE COULD LEARN ALL ABOUT THE SIZE AND BRIGHTNESS OF VARIOUS DISPLAYS, ONE COULD NOT FORM ANY JUDGMENT ABOUT HOW EFFECTIVELY THE DISPLAY TRANSFERRED INFORMATION TO AN OBSERVER. THIS TEXT ATTEMPTS TO FORMULATE A CONSOLIDATED THEORY OF HOW INFORMATION IS TRANSFERRED FROM DISPLAY TO OBSERVER, BASED ON BOTH PREVIOUS THEORIES AND RECENT EMPIRICAL INVESTIGATIONS. (A, ABBR.)

COMMENTS:

THIS TEXT PRESENTS AN EXTENSIVE DISCUSSION OF PHYSICS AND ENGINEERING APPROACHES TO THE DESIGN OF PHOTOELECTRONIC DEVICES AND OF PSYCHOPHYSICS AND HUMAN VISION. THE REVIEW OF THE LITERATURE IN THESE AREAS IS COMPREHENSIVE AND PRESENTED VERY WELL. ALTHOUGH THIS WOULD BE AN EXCELLENT SOURCE BOOK FOR THOSE WITH SOME BACKGROUND IN THE PERCEPTION OF DISPLAYED INFORMATION, THIS TEXT WOULD NOT BE SUITABLE AS AN INTRODUCTION. IT IS ASSUMED THAT THE READER IS FAMILIAR WITH THE PHYSICS OF OPTICS AND PSYCHOPHYSICAL THEORIES AND TECHNIQUES.

GENERAL DISCUSSION OF THE POTENTIAL OF INTERACTIVE SYSTEMS BOEHM, B.W. KEEPING THE UPPER HAND IN THE MAN-COMPUTER PARTNERSHIP (TECHNICAL REPORT RP-3533). SANTA MONICA, CALIFORNIA: RAND CORP., APRIL 1967 (SIMILAR PAPER IN ASTRONAUTICS AND AERONAUTICS, APRIL 1967). (NTIS NO. AD 650371) DESCRIPTION:

THIS ARTICLE IS AN ATTEMPT TO TELL AEROSPACE PROFESSIONALS WHERE WE STAND IN ACHIEVING THE GOAL OF EFFECTIVE MAN-COMPUTER PARTNERSHIP AND TO POINT OUT SOME OF THE IMPLICATIONS OF CURRENT PRACTICES. THE AREAS CONSIDERED INCLUDE HARDWARE TRENDS, REAL-TIME OPERATIONS, CONVERSATIONAL COMPUTING, COMPUTER FACILITIES AND SYSTEMS ANALYSIS REQUIREMENTS. 29P. 18R.

#### COMMENTS:

AT THE TIME THIS PAPER WAS WRITTEN, PEOPLE WERE BECOMING AWARE THAT A PROPERLY DESIGNED COMPUTER SYSTEM COULD BE USED TO AUGMENT MAN'S INTELLECTUAL AND PROBLEM SOLVING ABILITIES. THIS PAPER FOCUSES ON THE STATE-OF-THE-ART IN HARDWARE AND SOFTWARE DEVELOPMENTS AND CONSIDERS EMERGING TRENDS IN THESE AREAS THAT WOULD FACILITATE EFFECTIVE SYSTEM DESIGN. MORE RECENT DEVELOMENTS IN HARDWARE AND SOFTWARE TECHNOLOGY MAKE THESE DISCUSSIONS SOMEWHAT DATED. HOWEVER, THE CONCEPTS THAT COMPUTER SYSTEMS ARE INTENDED TO AID, AND NOT REPLACE, HUMAN CREATIVITY AND THAT A COMPUTER SYSTEM MUST BE RESPONSIVE TO HUMAN NEEDS AND EASY TO USE ARE STILL VALID. THIS PAPER MAY BE OF HISTORICAL INTEREST TO THOSE CONCERNED WITH FOLLOWING DEVELOPMENTS IN THE GENERAL AREA OF MAN-COMPUTER INTERACTION.

## SYSTEM DESIGN AND EVALUATION METHODS

BOEHM, B.W. COMPUTER SYSTEMS ANALYSIS METHODOLOGY: STUDIES IN MEASURING, EVALUATING, AND SIMULATING COMPUTER SYSTEMS (TECHNICAL REPORT R-520-NASA) SANTA MONICA, CALIFORNIA: RAND CORP., SEPTEMBER, 1970. (NASA ACCESSION NO. N71-13504)

DESCRIPTION:

THIS REPORT SUMMARIZES THE RESULTS OF A GROUP OF COMPUTER SYSTEM ANALYSIS AND SIMULATION STUDIES. IT CONCENTRATES ON THE KEY RESULTS OF THESE INDIVIDUAL STUDIES AND THEIR APPLICABILITY TO THE DESIGN, DEVELOPMENT, AND MANAGEMENT OF COMPLEX COMPUTER SYSTEMS. SHOULD BE OF INTEREST TO PLANNERS, MANAGERS, AND ANALYSTS OF BOTH COMPLEX COMPUTER SYSTEMS AND THE MISSION-ORIENTED SYSTEMS IN WHICH THEY ARE EMBEDDED. (A, ABBR.) 53P, 17R.

#### COMMENTS:

THE FIRST TWO SECTIONS OF THIS PAPER DISCUSS THE 'EXTENDABLE COMPUTER SYSTEM SIMULATOR (ECSS), A PROTOTYPE LANGUAGE FOR THE SIMULATION OF COMPLEX COMPUTER SYSTEMS, AND SOME OF THE PROBLEMS ASSOCIATED WITH COMPUTER SYSTEM MEASUREMENT AND EVALUATION. A BRIEF INTRODUCTION TO EACH OF THESE AREAS IS PROVIDED, BUT NO SUBSTANTIVE INFORMATION IS PRESENTED. THE THIRD SECTION OF THIS PAPER DESCRIBES AN EXPERIMENT ON THE EFFECTS OF FORCED "LOCKOUT" ON THE USERS OF INTERACTIVE SYSTEMS. AN APPENDIX DESCRIBES THE \*PRODUCTIVE THOUGHT RATIO \* AS A PERFORMANCE CRITERION FOR MAN-COMPUTER THE READER INTERESTED IN EITHER OF THESE LATTER TWO TOPICS SYSTEMS. IS REFERRED TO B.W. BOEHM, M.J. SEVEN, AND R.A. WATSON (1971), WHICH IS MORE READILY AVAILABLE.

45 EFFECT OF "LOCKOUT" ON PROBLEM SOLVING
BOEHM, B.W., SEVEN, M.J., & WATSON, R.A. INTERACTIVE PROBLEM-SOLVING: AN
EXPERIMENTAL STUDY OF "LOCKOUT" EFFECTS. AFIPS CONFERENCE PROCEEDINGS, 1971, 38,
205-210.
DESCRIPTION:

THIS PAPER REPORTS AN EXPERIMENT DESIGNED TO TEST M.M. GOLD'S (1967) HYPOTHESIS THAT RESTRICTING A PROBLEM SOLVER'S ACCESS TO THE COMPUTER FOR SOME PERIOD OF TIME AFTER THE PRESENTATION OF THE RESULTS FROM THE CURRENT REQUEST ("LOCKOUT" PERIOD), MIGHT IMPROVE PERFORMANCE BY INDUCING THE USER TO CONCENTRATE MORE ON THE PROBLEM TO BE SOLVED AND LESS ON THE TACTICS BEING DEVELOPED TO SOLVE IT. THE RESULTS INDICATE THAT ALTHOUGH LOCKOUT IMPROVES PERFORMANCE, IT CAUSES SUBJECTS TO BE LESS SATISFIED WITH THE SYSTEM. AN APPENDIX DESCRIBES THE FORMULATION OF A CRITERION FOR EVALUATING MANCOMPUTER SYSTEMS, THE PRODUCTIVE THOUGHT RATIO, AND CONSIDERS THE IMPLICATIONS OF USING THIS CRITERION.

6P, 4R.

COMMENTS:

IN MOST STUDIES OF INTERACTIVE SYSTEMS, "RESPONSE TIME" IS DEFINED AS THE TIME BETWEEN A USER'S REQUEST AND A SYSTEM'S RESPONSE. A SECOND COMPONENT OF THE INTERACTIVE CYCLE IS THE TIME BETWEEN THE SYSTEM'S RESPONSE AND THE USER'S NEXT REQUEST. IN THE TIME BETWEEN THE RECEIPT OF OUTPUT AND THE NEXT REQUEST, A USER MUST ANALYZE THE OUTPUT, DECIDE WHAT CHANGES SHOULD BE MADE, DETERMINE HOW TO IMPLEMENT THESE CHANGES, AND INPUT THE NEXT COMMAND. GOLD (1967) OBSERVED THAT THE INITIAL INTERACTIONS, AFTER A LONG ELAPSED TIME SINCE RECEIPT OF THE LAST OUTPUT, WERE PRIMARILY USED TO MAKE MAJOR CHANGES TO THE USER'S DECISION RULES OR SOLUTION STRATEGIES, AND THAT SUBSEQUENT INTERACTIONS WERE USED PRIMARILY TO MAKE MINOR MODIFICATIONS TO THESE EXISTING RULES AND STRATEGIES. THIS LED HIM TO SPECULATE THAT IMPROVEMENTS IN PERFORMANCE ARE MUCH GREATER IN THE INITIAL INTERACTIONS THAN IN SUBSEQUENT INTERACTIONS. THE EXPERIMENT REPORTED IN THE PRESENT PAPER CONFIRMS THIS HYPOTHESIS. IT WAS ALSO NOTED, HOWEVER, THAT USERS EXPRESSED DISSATISFACTION WHEN RESTRAINTS WERE PLACED ON THEIR FREE INTERACTION WITH THE SYSTEM. ALTHOUGH THIS TENDS TO INDICATE THAT USER ACCEPTANCE MAY NOT BE A VALID MEASURE OF SYSTEM EFFECTIVENESS, IT ALSO INDICATES THE NEED TO CONSIDER THE TRADEOFF BETWEEN USER PERFORMANCE AND USER SATISFACTION.

66 STATISTICS ON USE OF TIME-SHARING SYSTEM
BOIES, S.J. USER BEHAVIOR ON AN INTERACTIVE COMPUTER SYSTEM. IBM SYSTEMS
JOURNAL, 1974, 13, 2-18.
DESCRIPTION:

THE USER-COMPUTER SYSTEM INTERACTIONS DESCRIBED HERE ARE CONFINED TO IBM/360 TIME SHARING SYSTEM (TSS) AND ITS TERMINALS. THE VARIOUS FACTORS DISCUSSED ARE: THE DURATION AND FREQUENCY OF TERMINAL SESSIONS, THE USER OF LANGUAGE PROCESSORS, COMMAND USAGE AND USER RESPONSE TIME. THE DATA INDICATE THAT A VERY SMALL PERCENTAGE OF USERS ACCOUNT FOR A LARGE PERCENTAGE OF THE TOTAL TERMINAL USAGE. USERS SELDOM USE THE ERROR CORRECTION FEATURES OF THE LANGUAGE PROCESSOR EVEN IF THEY NEED THEM. A LONG SYSTEM RESPONSE TIME IS RELATED TO A LONG USER RESPONSE TIME. ONLY A SMALL NUMBER OF COMMANDS ACCOUNT FOR A LARGE FREQUENCY OF USAGE. WHEN ONE COMMAND WOULD HAVE BEEN SUFFICIENT SEVERAL COMMANDS ARE OFTEN USED BY THE USERS. (0) 17P, 10R.

COMMENTS:

THIS PAPER REPORTS STATISTICS ON THE USE OF AN INTERACTIVE PROGRAMMING SYSTEM AT AN IBM RESEARCH CENTER. USERS OF THESE SPECIFIC DATA MUST KEEP IN MIND THAT THIS ENVIRONMENT MAY DIFFER SOMEWHAT FROM A TYPICAL PRODUCTION PROGRAMMING ENVIRONMENT. THE MAJOR TRENDS REPRESENTED IN THE DATA ARE SIMILAR TO THOSE REPORTED IN OTHER ENVIRONMENTS, HOWEVER, AND ARE PROBABLY FAIRLY GENERALLY TRUE OF USER BEHAVIOR IN INTERACTIVE PROGRAMMING (BUT NOT, OF COURSE, APPLICATION) SYSTEMS. THE PAPER IS PROBABLY OF MOST INTEREST TO THOSE INVOLVED IN SOFTWARE DESIGN FOR TIME-SHARING OPERATING SYSTEMS.

47 STATISTICS ON USE OF INTERACTIVE DEBUGGING FACILITIES
BOIES, S.J., & SPIEGEL, M.F. A BEHAVIORAL ANALYSIS OF PROGRAMMING: ON THE USE
OF INTERACTIVE DEBUGGING FACILITIES (TECHNICAL REPORT RC-4472). YORKTOWN
HEIGHTS, NEW YORK: IBM WATSON RESEARCH CENTER, AUGUST 1973. (NTIS NO. AD
772127)

DESCRIPTION:

MEASUREMENT AND ANALYSIS OF USER DEBUGGING BEHAVIOR ON PRESENT INTERACTIVE SYSTEMS CAN LEAD TO AN UNDERSTANDING OF HOW FUTURE INTERACTIVE SYSTEMS SHOULD BE IMPLEMENTED. THIS STUDY PRESENTS BOTH AN ANALYSIS OF THE ON-LINE USAGE OF THE TSS/360 PROGRAM CONTROL SYSTEM (PCS) AS WELL AS THE RESULTS OF A QUESTIONNAIRE DESIGNED TO PROBE THE PCS KNOWLEDGE OF THE POPULATION OF USERS OF THAT SYSTEM. THE QUESTIONNAIRE RESPONSE POPULATION TENDED TO BE DIVIDED INTO THREE COMPETENCE GROUPS, THE HIGHEST OF WHICH CONSISTED MOSTLY OF SYSTEM SUPPORT PERSONNEL AND ASSEMBLER LANGUAGE PROGRAMMERS. THE ON-LINE USAGE ANALYSIS SHOWED THAT PCS COMMANDS ACCOUNTED FOR 7.2 PERCENT OF ALL COMMANDS ENTERED BY PROGRAMMERS. PCS WAS USED RARELY TO MODIFY THE LOGIC OF A PROGRAM, BUT WAS USED AS A PROGRAM VARIABLE INPUT/OUTPUT SYSTEM. IT WAS CONCLUDED THAT THE UNDERSTANDING OF THE INTERACTIVE DEBUGGING PROCESS MUST COME FROM THE PERSPECTIVE OF THE ENTIRE SYSTEM, AS UP TO 50 PERCENT OF THE DEBUGGING EFFORT IS SPENT ON TASK AND DATA MANAGEMENT. FIVE CRITICAL FEATURES OF AN EFFECTIVE INTERACTIVE PROGRAMMING SYSTEM ARE OUTLINED. (A) 25P, 12R.

AS WITH ALL STATISTICAL SUMMARIES OF USER BEHAVIOR, ONE MUST KEEP IN MIND THAT THIS REPORT DESCRIBES BEHAVIOR WHICH OCCURRED IN THE CONTEXT OF A PARTICULAR SYSTEM AND A PARTICULAR ENVIRONMENT. IN THIS CASE, THE ENVIRONMENT IS THAT OF AN IBM RESEARCH CENTER, WHICH MAY WELL BE ATYPICAL. WITH THOSE CAVEATS, THOUGH, THE DATA REPORTED HERE DO YIELD SOME INSIGHT INTO USE OF ON-LINE DEBUGGING AND TEXT EDITING AIDS BY PROGRAMMERS. THE FEATURES RECOMMENDED FOR INTERACTIVE PROGRAMMING FACILITIES ARE REASONABLE AND ARE AT LEAST LOOSELY JUSTIFIED BY THE USAGE PATTERNS OBSERVED. THEY PERTAIN TO FACILITIES FOR DATA MANAGEMENT, TEXT EDITING, PROGRAM CONTROL, PROGRAM ALTERATION AT EXECUTION TIME, AND COMPATIBILITY BETWEEN THE INTERACTIVE PROGRAMMING SYSTEM AND THE PROGRAMMING LANGUAGE WITH WHICH IT IS USED. THE PAPER SHOULD BE USEFUL TO THOSE CONCERNED WITH INTERACTIVE PROGRAMMING AND DEBUGGING, BUT PROBABLY LACKS APPEAL FOR ANY WIDER AUDIENCE.

48 PICTORIAL VERSUS TEXTUAL DISPLAYS
BOOHER, H.R. RELATIVE COMPREHENSIBILITY OF PICTORIAL INFORMATION AND PRINTED
WORDS IN PROCEDURALIZED INSTRUCTIONS. HUMAN FACTORS, 1975, 17, 266-277.
DESCRIPTION:

A STUDY WAS CONDUCTED TO COMPARE THE RELATIVE COMPREHENSIBILITY OF PICTORIAL INFORMATION AND PRINTED WORDS IN INSTRUCTIONS. SIX PICTURE-WORD FORMATS WERE EXAMINED USING 24 PROCEDURAL PROBLEMS ON THREE TYPES OF TASKS. THE FORMATS WERE PRINT-ONLY, PICTORIAL-ONLY, PICTORIAL-RELATED PRINT, PRINT-RELATED PICTORIAL, PICTORIAL-REDUNDANT PRINT, AND PRINT-REDUNDANT PICTORIAL. THE RESULTS SHOWED PICTORIAL INFORMATION IMPORTANT FOR SPEED BUT PRINT INFORMATION NECESSARY FOR ACCURACY. COMPREHENSION OF INSTRUCTIONS ON ALL THREE TASKS WAS MOST EFFICIENT WITH THE PICTORIAL-RELATED PRINT AND PICTORIAL-REDUNDANT PRINT FORMATS BUT COULD NOT BE SHOWN TO BE SIMPLY A FUNCTION OF NUMBER OF VISUAL INFORMATION CHANNELS USED OR THE DEGREE OF REDUNDANCY BETWEEN CHANNELS. THE TYPE OF INFORMATION DISPLAYED IN THE VISUAL CHANNELS WAS FOUND TO BE IMPORTANT. (A) 12P, 15R.

COMMENTS:

THE EXPERIMENT REPORTED IN THIS PAPER APPEARS TO HAVE BEEN CAREFULLY CONTROLLED AND IS PRESENTED IN A CLEAR, CONCISE MANNER. ALTHOUGH THIS STUDY WAS CONCERNED WITH CONVEYING PROCEDURAL INSTRUCTIONS FOR EQUIPMENT OPERATION, THE RESULTS MAY BE APPLICABLE TO A WIDE RANGE OF TASK ENVIRONMENTS. THE SPECIFIC TASKS USED IN THIS STUDY INVOLVED LOCATING CONTROLS ON A CONTROL PANEL, COMPARING CONTROL SETTINGS WITH DESIRED SETTINGS, AND RECOGNIZING PROBLEMS. THE PRINCIPAL RESULT IS THAT A PICTORIAL FORMAT RESULTED IN FASTER PERFORMANCE BUT A PRINT (VERBAL) FORMAT RESULTED IN MORE ACCURATE PERFORMANCE. IT SEEMS POSSIBLE THAT THIS SPEED—ACCURACY EFFECT COULD ALSO BE OBSERVED IN A VARIETY OF TASKS. THIS PAPER CONTAINS SOME INTERESTING IDEAS FOR FURTHER RESEARCH ON THE EFFECTS OF INFORMATION PRESENTATION FORMAT. FOR EXAMPLE, THE AUTHOR NOTES THAT THIS STUDY IS LIMITED TO PERCEPTUAL AND SHORT-TERM MEMORY PROCESSES, AND SUGGESTS THAT THE LONG-TERM EFFECTS OF INFORMATION PRESENTATION FORMAT WOULD BE WORTH CONSIDERING. IN ADDITION, THE QUESTION OF HOW DIFFERENT TYPES OF TASKS INTERACT WITH INFORMATION PRESENTATION FORMAT SHOULD ALSO BE CONSIDERED.

49 COMPUTER-AIDED PATTERN RECOGNITION
BOOTH, T.L., KAUFMAN, H.M., LAMB, J., LEVY, R.M., REISS, R.A., SHOLL, H.A., &
VOGELLI, G. EXPERIMENTAL INVESTIGATIONS OF MAN-MACHINE PROCESSING OF
INFORMATION (VOL. III) (TECHNICAL REPORT U417-68-098). GROTON, CONNECTICUT:
GENERAL DYNAMICS CORP., OCTOBER 1968. (NTIS NO. AD 684838)
DESCRIPTION:

THE AIM OF THIS PROJECT IS TO PROVIDE BASIC KNOWLEDGE OF THE METHODS WHICH MAY BE USED BY A MAN-COMPUTER SYSTEM TO DETECT THE PRESENCE OF A TARGET, USING DATA FROM A PASSIVE SONAR RECEIVER. THIS RESEARCH CONSISTS OF ANALYTICAL STUDIES TO EVALUATE IMPORTANT SYSTEM PARAMETERS AND EXPERIMENTAL INVESTIGATIONS MEASURING OPERATOR PERFORMANCE UNDER VARIOUS OPERATING CONDITIONS.

THE FIRST TWO REPORTS IN THIS WOLUME DESCRIBE THE EFFECTS OF PATTERN VARIATIONS ON HUMAN PATTERN RECOGNITION. THE RESULTS MEASURED THE OPERATOR'S ABILITY TO VISUALLY DETECT PATTERNS DIFFERING IN SHAPE AND TO DETECT PATTERNS GENERATED BY STATISTICALLY DEPENDENT SEQUENCES.

DETECT PATTERNS GENERATED BY STATISTICALLY DEPENDENT SEQUENCES.

THE SECOND TWO REPORTS DEAL WITH BASIC HUMAN INFORMATION PROCESSING AND DESCRIBE THE TESTING OF A PREDICTIVE MODEL FOR REACTION TIME TO VISUAL STIMULI AND A TEST OF THE EFFECTS OF NUMBER OF STIMULI ON MEMORY SPAN. (A) 154P, 22R.

COMMENTS:

THE FIRST PHASE OF A PROBLEM SOLVING TASK INVOLVES RECOGNIZING THAT A PROBLEM EXISTS. IN GENERAL, PEOPLE ARE FREQUENTLY SLOW TO RECOGNIZE, OR AT LEAST REACT TO, PROBLEMS. THIS IS ESPECIALLY TRUE IN SITUATIONS IN WHICH A HUMAN OPERATOR MUST MONITOR THE CURRENT STATE OF THE ENVIRONMENT AND DETECT CRITICAL CHANGES. IN THOSE CASES IN WHICH A COMPUTER IS USED TO COMMUNICATE THE CURRENT STATE OF THE ENVIRONMENT TO THE OPERATOR, PROBLEM RECOGNITION COULD BE FACILITATED BY MANIPULATING THE MANNER IN WHICH THIS INFORMATION IF PRESENTED. THIS PAPER EXAMINES SOME FACTORS THAT AFFECT AN OPERATOR'S ABILITY TO ASSIMILATE AND REACT TO DISPLAYED INFORMATION. THE RESULTS OF SUCH RESEARCH COULD BE USED TO DEVELOP AUTOMATED AIDS FOR THE PROBLEM RECOGNITION PROCESS.

MAN-COMPUTER DIALOGUE

BORKO, H. UTILIZATION OF ON-LINE INTERACTIVE DISPLAYS (REPORT NO. SP-2575).

SANTA MONICA, CALIFORNIA: SYSTEM DEVELOPMENT CORP., AUGUST 1966.

(NTIS NO. AD 640652)

DESCRIPTION:

THE VERSATILITY AND ADVANTAGES OF USING ON-LINE INTERACTIVE DISPLAYS ARE ILLUSTRATED BY EXAMPLES FROM (1) THE GENERAL PURPOSE DISPLAY SYSTEM (GPDS), (2) THE PATTERN LEARNING PARSER (PLP II), AND (3) THE BIBLIOGRAPHIC ON-LINE DISPLAY SYSTEM (BOLD). ALTHOUGH THESE SYSTEMS ARE DESIGNED FOR DIFFERENT PURPOSES THEY ALL UTILIZE DISPLAYS AS COMMUNICATION CHANNELS BY WHICH THE MAN AND THE MACHINE ARE ABLE TO ENGAGE IN A DIALOG AND WORK TOGETHER TO SOLVE PROBLEMS. THE COMPUTER PROCESSES DATA RAPIDLY AND DISPLAYS THE RESULTS. THE INFORMATION PROVIDED IN THE DISPLAYS ENABLES THE USER TO STEER AND CONTROL THE STEP-BY-STEP PROGRESS OF THE PROGRAM. NOT ONLY ARE PROBLEMS SOLVED MORE EFFICIENTLY, BUT THE USERS ARE MORE SATISFIED BY THE RESULTS ACHIEVED. (A) 32P, 8R.

COMMENTS:

THIS PAPER DISCUSSES THREE SYSTEMS WITH A VARIETY OF OPERATOR INPUT/OUTPUT DEVICES, INCLUDING TELETYPE, CRT WITH LIGHTPEN, AUXILIARY KEYBOARD, RAND TABLET, AND A "CONTROL FUNCTION SELECTION PANEL". APPLICATIONS DISCUSSED INCLUDE LINGUISTICS, BIBLIOGRAPHIC SEARCH, AND A GENERAL-PURPOSE COMPUTATION AND DISPLAY PACKAGE FOR USE BY NONPROGRAMMERS. DIALOGUE TECHNIQUES ARE DISCUSSED AND ILLUSTRATED FOR THE PARTICULAR SYSTEMS DISCUSSED. THE PAPER MAY BE OF INTEREST TO THOSE CONCERNED WITH MAN-COMPUTER DIALOGUE IN THE PARTICULAR APPLICATION AREAS DISCUSSED.

51 GEOGRAPHICAL DISPLAYS FOR ARMY TACTICAL INTELLIGENCE
BOHEN, R.J., FEEHRER, C.E., NICKERSON, R.S., & TRIGGS, T.J. COMPUTER-BASED
DISPLAYS AS AIDS IN THE PRODUCTION OF ARMY TACTICAL INTELLIGENCE (TECHNICAL
PAPER 258). ARLINGTON, VIRGINIA: U.S. ARMY RESEARCH INSTITUTE FOR THE
BEHAVIORAL AND SOCIAL SCIENCES, FEBRUARY 1975. (NTIS NO. AD A007819)
DESCRIPTION:

MAN-MACHINE INTERACTIVE COMPUTER-BASED DISPLAY TECHNIQUES ARE EVALUATED FOR THEIR AUTOMATIC DATA PROCESSING (ADP) APPLICATIONS IN COMBAT INTELLIGENCE. ANALYSIS OF A TACTICAL EXERCISE HELPS CONCEPTUALIZE AND FORMULATE DISPLAY FORMATS AND PROCEDURES FOR TRANSPOSING MILITARY EXERCISES INTO DATA BASE STRUCTURES WHICH SUPPORT COMPUTER-GENERATED SITUATION DISPLAYS. CONCEPTS OF MASS AND MOVEMENT ANALYSES USING INTERACTIVE DISPLAYS ARE DEVELOPED. ADP PROBLEMS OF SOFTWARE, MEMORY, AND INFORMATION ORGANIZATION ARE CONSIDERED. IMPLEMENTATION OF A PROTOTYPE SYSTEM WILL VALIDATE THE ANALYTIC METHODS DEVELOPED HERE AND EXPLORE OTHER TECHNIQUES WHICH ALSO CAPITALIZE ON THE COMPUTER'S CONTROL OF THE SPECIFIC DISPLAYS TO BE GENERATED. (A) 76P, OR.

COMMENTS:

THE OVERALL GOAL OF THE PROJECT DESCRIBED IN THIS PAPER IS TO DEVELOP DYNAMIC COMPUTER-BASED AIDS FOR ARMY TACTICAL INTELLIGENCE ANALYSTS. THE EMPHASIS OF THIS PAPER IS ON ILLUSTRATING THE TYPES OF DISPLAYS THAT COULD BE COMPUTER GENERATED RATHER THAN ON SPECIFYING THE TYPES OF DISPLAYS THAT SHOULD BE GENERATED IN ORDER TO EFFECTIVELY AID THE ANALYST. IT IS ASSUMED THAT CRITICAL INSIGHTS INTO THE DESIRED SYSTEM CAPABILITIES AND FEATURES CAN ONLY BE DEVELOPED FROM ANALYSTS WHO CAN INTERACT WITH A TROTOTYPE VERSION OF THE SYSTEM. THIS PAPER MIGHT ALSO INTEREST THOSE CONCERNED WITH GEOGRAPHICAL DISPLAYS FOR OTHER PURPOSES THAN TACTICAL INFORMATION.

52 HUMAN FACTORS IN COMPUTER SYSTEMS (GENERAL)
BRIDGEWATER, J. HUMAN FACTORS IN THE DESIGN OF ELECTRONIC COMPUTERS.
COMPUTERS AND AUTOMATION, JULY 1954, 3(6), PP. 6-7, 10, 17.
DESCRIPTION:

THE OPERATION OF COMPUTERS REQUIRES CONSIDERABLE CONTACT WITH HUMANS. ALTHOUGH MACHINE RELIABILITY HAS IMPROVED GREATLY, HUMANS ARE STILL HIGHLY SUSCEPTIBLE TO ERROR. THERE ARE TWO WAYS IN WHICH TO IMPROVE HUMAN PERFORMANCE IN MAN-MACHINE INTERACTIONS -- EITHER THE MAN CAN BE SELECTED AND TRAINED TO BETTER FIT THE MACHINE OR THE MACHINE CAN BE DESIGNED TO BETTER FIT THE MAN. THIS PAPER PRESENTS GUIDELINES FOR THE LATTER APPROACH. 4P, 17R.

COMMENTS:

THIS PAPER PRESENTS AN EARLY DISCUSSION OF THE NEED FOR HUMAN ENGINEERING IN THE DESIGN OF COMPUTER SYSTEMS. THE AUTHOR BRIEFLY CONSIDERS ANTHROPOMETRIC, PHYSIOLOGICAL, AND PSYCHOLOGICAL FACTORS THAT ARE RELEVANT TO SYSTEM DESIGN. ALTHOUGH GUIDELINES FOR SYSTEM DESIGN ARE NOT PRESENTED, AREAS WHERE STUDY AND RESEARCH ARE REQUIRED ARE DESCRIBED. ALTHOUGH MUCH OF THIS RESEARCH HAS BEEN DONE SINCE THIS PAPER WAS WRITTEN, THE RAPIDLY CHANGING NATURE OF COMPUTER SYSTEMS.

53. NATURAL-LANGUAGE PROCESSING

BROWN, J.S., BURTON, R.R., BELL, A.G., & BOBROW, R.J. SOPHIE: A SOPHISTICATED INSTRUCTIONAL ENVIRONMENT (TECHNICAL REPORT AFHRL-TR-74-93). BROOKS AIR FORCE BASE, TEXAS: AIR FORCE HUMAN RESOURCES LABORATORY, DECEMBER 1974. (NTIS NO. AD AD10109)

DESCRIPTION:

THE SOPHIE PROGRAM, WHICH IMPLEMENTS MIXED INITIATIVE COMPUTER-ASSISTED INSTRUCTION WITHIN A SIMULATED ELECTRONICS TROUBLESHOOTING TRAINING LABORATORY INTERACTION, HAS BEEN EXTENDED IN SEVERAL MANNERS. THE LANGUAGE PROCESSOR NOW ACCEPTS ELLIPSES AND OTHER NONSPECIFIC REQUESTS, AND RESOLVES THESE FROM DIALOGUE CONTEXT. A HELP REQUESTING FACILITY HAS BEEN PROVIDED WHICH WILL SUGGEST POSSIBLE FAULTS (BASED ON THE STUDENT'S KNOWLEDGE ABOUT THE CIRCUIT AT THE TIME OF REQUEST) WHICH COULD EXPLAIN THE SYMPTOMS HE HAS OBSERVED. THE NET EFFECT OF MODIFICATIONS IS THAT A DIALOGUE IS MUCH MORE LIKE A CONVERSATION WITH A VERY SKILLED TUTOR WHO CAN INFER WHAT A STUDENT MEANS, BASED ON A COMPLETE INTERACTION SESSION, AND RESPOND APPROPRIATELY. THE RESULTING PROGRAM CAN BE ASSESSED THROUGH THE ARPA NETWORK OF COMPUTERS. (A)

48P, 13R.

THE MAJOR GOAL OF SOPHIE IS TO PRODUCE A "REACTIVE" LEARNING ENVIRONMENT; THAT IS, AN ENVIRONMENT IN WHICH THE STUDENT IS FREE TO EMPLORE IDEAS, CREATE HYPOTHESES, ETC., AND THEN TO RECEIVE IMMEDIATE FEEDBACK AS TO THE VALIDITY OF THESE IDEAS. THE PRESENT PAPER IS CONCERNED WITH TECHNIQUES TO AID HELPFUL, NATURAL COMMUNICATION WITH THE STUDENT. THIS PAPER IS CONCERNED WITH EXTENSIONS TO SOPHIE AND DOES NOT DESCRIBE THE BASIC PROPERTIES OF SOPHIE IN ANY DETAIL. BOTH THE HELP FACILITY AND THE LANGUAGE PROCESSOR DESCRIBED HERE ARE EXAMPLES OF THE APPLICATION OF ARTIFICIAL INTELLIGENCE TO COMPUTER-ASSISTED INSTRUCTION. THIS PAPER MOULD BE OF INTEREST TO THOSE INTERESTED IN COMPUTER-ASSISTED INSTRUCTION, NATURAL-LANGUAGE DIALOGUE, OR ARTIFICIAL INTELLIGENCE.

DECISION AIDS FOR TASK FORCE COMMANDER
BROWN, R.V., PETERSON, C.R., SHAWCROSS, W.H., & ULVILA, J.W. DECISION
ANALYSIS AS AN ELEMENT IN AN OPERATIONAL DECISION AIDING SYSTEM (PHASE II)
(TECHNICAL REPORT 75-13). MCLEAN, VIRGINIA: DECISIONS AND DESIGNS, INC.,
NOVEMBER 1975. (NTIS NO. AD A018109)
DESCRIPTION:

CONTINUING DECISION ANALYTIC RESEARCH AND THE INITIAL DEVELOPMENT OF SEVERAL PROTOTYPE DECISION AIDS, FOR THE TACTICAL SUPPORT OF NAVAL TASK FORCE COMMANDERS, ARE REPORTED IN THIS PAPER. FOCUS IS ON THE POTENTIAL CONTRIBUTION OF ADVANCE TECHNIQUES OF DECISION ANALYSIS AS DECISION AIDS IN THE DEVELOPMENT OF OPERATIONAL PLANS AND AS AN ACTION SELECTION TOOL IN THE MISSION EXECUTION PHASE OF TASK FORCE OPERATIONS.

MISSION EXECUTION PHASE OF TASK FORCE OPERATIONS.—

NINE PROTOTYPE AIDS WERE SPECIFIED AND DEVELOPED TO VARYING DEGREES FOR USE ON THE INTERACTIVE GRAPHICS TERMINAL. THE INTERACTIVE TERMINAL FACILITATED THE ENTRY OF PARAMETRIC CHANGES SUCH AS ARE REQUIRED WHEN THE THREAT, ENVIRONMENT, ETC. CHANGE, AS WELL AS STRUCTURAL CHANGES TO THE MODEL ITSELF. IN ADDITION, THE IMMEDIACY OF THE RESULTS ON THE INTERACTIVE TERMINAL PERMITS DECISION MAKERS THE OPPORTUNITY OF PERFORMING SENSITIVITY ANALYSIS BY ASKING "WHAT IF" KINDS OF QUESTIONS. AID SUITABILITY WAS EXAMINED THROUGH APPLICATION TO REPRESENTATIVE OPERATIONAL SITUATIONS DRAWN FROM SELECTED SCENARIOS IN CONJUNCTION WITH WORKSHOP TRIALS INVOLVING EXPERIENCED NAVAL PERSONNEL AND DECISION ANALYSTS. (A)

#### COMMENTS:

THERE ARE OBVIOUS ADVANTAGES TO PROVIDING SOME TYPE OF DECISION MAKING, OR PROBLEM SOLVING, AIDS FOR COMMAND AND CONTROL SETTINGS. SUCH AIDS COULD TAKE SEVERAL FORMS. IN THIS PAPER, DECISION MAKING IN A COMMAND AND CONTROL SETTING IS CONSIDERED TO BE A TYPE OF MULTIPLE CRITERION DECISION MAKING. THE PROPOSED AIDS, THEREFORE, REQUIRE THE DECISION MAKER TO SPECIFY ALTERNATIVES, EVALUATE THESE ALTERNATIVES, ASSESS THE PROBABILITY OF ENEMY ACTIONS, ETC. THE DECISION AIDS THEN ASSIGN A RELATIVE VALUE TO EACH CONSIDERED ALTERNATIVE. ALTHOUGH SUCH DECISION AIDS MAY BE USEFUL, THE DISADVANTAGES OF SUCH AIDS SHOULD ALSO BE CONSIDERED. SUCH AN AID PLACES ON THE DECISION MAKER THE TASK OF SPECIFYING ALTERNATIVES AND THE DIMENSIONS ON WHICH THESE ALTERNATIVES SMOULD BE EVALUATED. IT MAY BE THE CASE THAT THE DECISION MAKER NEEDS MORE HELP WITH THESE TASKS THAN WITH ALTERNATIVE EVALUATION. THIS TOPIC, HOWEVER, IS NOT ADRESSED IN THIS PAPER. IN ADDITION, THE PROCEDURES FOR USING THE DECISION AIDS DESCRIBED IN THIS PAPER APPEAR TO BE BOTH TIME CONSUMING AND OBTRUSIVE. IF SUCH AIDS ARE TO BE USED BY A TASK FORCE COMMANDER, THESE ARE SERIOUS DISADVANTAGES. A CASK FORCE COMMANDER MUST MAKE DECISIONS UNDER TIME PRESSURE AND HE IS LIKELY TO REJECT ANY AID THAT IS DIFFICULT TO USE OR WHOSE DECISION MAKING HEURISTICS HE DOES NOT UNDERSTAND. THUS, USER ACCEPTANCE MUST BE CAREFULLY CONSIDERED IN DESIGNING SUCH DECISION AIDS. ALTHOUGH SOME OF THE DECISION AIDS DESCRIBED IN THIS PAPER MAY BE USEFUL, ADEQUATE EMPIRICAL INVESTIGATIONS HAVE NOT BEEN PERFORMED.

STATISTICS ON USE OF A TIME-SHARING SYSTEM
BRYAN, G.E. JOSS: 20,000 HOURS AT A CONSOLE -- A STATISTICAL SUMMARY. AFIPS
CONFERENCE PROCEEDINGS, 1967, 31, 769-777 (ALSO: (TECHNICAL REPORT NO. RM-5359PR). SANTA MONICA, CALIFORNIA: RAND CORPORATION, AUGUST 1967).
DESCRIPTION:

JOSS IS A SPECIAL PURPOSE INTERACTIVE COMPUTATIONAL FACILITY. THIS PAPER REPORTS ON EFFORTS TO MEASURE SYSTEM USE AND CHARACTERISTICS OF INDIVIDUAL SYSTEM USERS. THIS ALLOWS THE ASSESSMENT OF HOW WELL THE SYSTEM MEETS THE DEMANDS OF A "TYPICAL" USER. OP 238.

9P, 23R. COMMENTS:

THIS IS ONE OF SEVERAL PAPERS THAT DESCRIBE THE JOSS SYSTEM. THIS PAPER REFLECTS THE CONCERN THAT AN INTERACTIVE SYSTEM SHOULD PROVIDE A FAST RESPONSE TO TYPICAL USER REQUESTS. IT IS ALSO NOTED THAT PEOPLE USE AN INTERACTIVE SYSTEM IN DIFFERENT WAYS. FOR EXAMPLE, SOME USE IT PRIMARILY AS A DESK CALCULATOR, OTHERS USE IT FOR INTERACTIVE PROBLEM SOLVING, ETC. THIS SUGGESTS THE NEED TO IDENTIFY DIFFERENT CLASSES OF USERS AND TO DESIGN A SYSTEM THAT IS RESPONSIVE TO THEIR UNIQUE REQUIREMENTS. JOSS IS A FAIRLY SPECIALIZED SYSTEM, AND GREAT CARE SHOULD BE USED IN GENERALIZING THE STATISTICAL DATA TO OTHER SETTINGS. ON THE OTHER HAND, THE MEASURES OF INTERACTIVE SYSTEMS USED HERE WOULD BE RELEVANT IN A VARIETY OF CONTEXTS. THESE MEASURES INCLUDE TIME AT THE CONSOLE, CPU TIME PER SESSION, NUMBER OF INPUT AND OUTPUT LINES PER SESSION, MEAN TIME BETWEEN INPUT LINES, FILE USAGE, MEAN PROGRAM SIZE, AND THE NUMBER AND TYPE OF MACHINE OPERATIONS PERFORMED PER SESSION.

DESIGN PARAMETERS OF CRT DISPLAYS

BRYDEN, J.E. DESIGN CONSIDERATIONS FOR COMPUTER DRIVEN CRT DISPLAYS. COMPUTER

DESIGN, MARCH 1969, 8(3), 38-46.

DESCRIPTION:

CATHODE RAY TUBE DISPLAYS HAVE BECOME A VERY IMPORTANT INTERFACE BETWEEN VISUAL COMMUNICATION CHANNELS OR COMPUTERS AND THE HUMAN OBSERVER. THIS ARTICLE REVIEWS CONSTRAINTS WITHIN THIS INTERFACE AND DISCUSSES SOME OF THE MORE IMPORTANT INTER-RELATIONSHIPS BETWEEN PARAMETERS. (A) 9P. 11R.

9P, 11R. COMMENTS:

THIS PAPER PRESENTS A BRIEF REVIEW OF SOME CHARACTERISTICS OF THE HUMAN VISUAL INFORMATION PROCESSING SYSTEM AND RELATES THESE CHARACTERISTICS TO VARIOUS PARAMETERS OF CRT DISPLAYS. THE PRIMARY EMPHASIS, HOWEVER, IS ON DISPLAY PARAMETERS AND THE AUTHOR PRESENTS A FAIRLY TECHNICAL DISCUSSION OF THIS AREA. THIS PAPER CONTAINS SEVERAL USEFUL GUIDELINES FOR THE DESIGN OF CRT DISPLAYS.

57 LEGIBILITY OF ALPHANUMERIC DISPLAYS
BUCKLER, A.T. A REVIEW OF THE LITERATURE ON THE LEGIBILITY OF ALPHANUMERICS
ON ELECTRONIC DISPLAYS (TECHNICAL MEMORANDUM 16-77). ABERDEEN PROVING GROUND,
MARYLAND: U.S. ARMY HUMAN ENGINEERING LAB., MAY 1977. (NTIS NO. AD AD40625)
DESCRIPTION:

THIS REPORT REVIEWS THE AVAILABLE LITERATURE ON THE LEGIBILITY OF ALPHANUMERIC DISPLAYS. THE PURPOSE WAS TO IDENTIFY THE IMPORTANT PARAMETERS INVOLVED IN LEGIBILITY AND TO PROVIDE A SUMMARY OF PREVIOUS RESEARCH FINDINGS IN THIS AREA. EFFORT WAS MADE TO DETERMINE THE ACCEPTABILITY OF PRINCIPLES DERIVED FROM CONVENTIONAL MEDIA FOR APPLICATIONS WITH ELECTRONIC DISPLAYS. ALSO, NEW QUESTIONS AND PROBLEMS CREATED BY ELECTRONIC DISPLAY TECHNOLOGY ARE DISCUSSED. CONCLUSIONS ARE DRAWN AND RECOMMENDATIONS MADE WHERE SUFFICIENT DATA ARE AVAILABLE, AND FURTHER QUESTIONS AND PROBLEMS ARE POSED FOR FUTURE RESEARCH. (A)

#### COMMENTS:

ALTHOUGH VERY BRIEF, THIS PAPER PRESENTS A VERY GOOD DISCUSSION OF PARAMETERS THAT AFFECT THE LEGIBILITY OF ALPHANUMERIC DISPLAYS AND PRESENTS A SET OF GUIDELINES FOR VALUES ON THESE PARAMETERS. THE PARAMETERS CONSIDERED ARE: 1) GENERATION TECHNIQUE, 2) SYMBOL SUBTENSE (OR VISUAL ANGLE SUBTENDED BY A CHARACTER), 3) RESOLUTION, 4) PERCENT ACTIVE AREA, 5) CONTRAST, 6) FONT, 7) SYMBOL-WIDTH-TO-HEIGHT, 8) STROKE-WIDTH-TO-HEIGHT, 9) SYMBOL SPACING, 10) VIEWING ANGLE, 11) EDGE DISPLAYED SYMBOLOGY, AND 12) COLOR. IT IS RECOMMENDED THAT DESIGNERS CONCENTRATE ON THE FIRST FIVE FACTORS. ADDITIONAL AREAS FOR FURTHER RESEARCH ARE ALSO SUGGESTED AND A FAIRLY EXTENSIVE BIBLIOGRAPHY IS INCLUDED.

58 HUMAN FACTORS CONSIDERATIONS IN TERMINAL DESIGN
BUCKLEY, J.E. TERMINALS: HUMAN FACTOR CONSIDERATIONS. COMPUTER DESIGN,
JULY 1974, 13(7), PP. 8; 10.
DESCRIPTION:

A TERMINAL-BASED COMPUTER SYSTEM FAILS TO PROVIDE THE EFFICIENCY ITS DESIGNERS HAD ANTICIPATED; AN ON-LINE APPLICATION PROVES TO BE MORE COSTLY AND CONSIDERABLY LESS EFFECTIVE THAN ITS DRIGINAL JUSTIFICATION ANALYSIS HAD PROJECTED; IMPLEMENTATION OF REMOTE TERMINALS TO AUTOMATE A DATA ENTRY OR INQUIRY APPLICATION CAUSES SUCH CONFUSION AND REMOTE SITE PERSONNEL DISRUPTION AS TO NEGATE ANY EXPECTED ADVANTAGES. THESE RESULTS, TOO OFTEN EXPERIENCED, CAN BE TRACED TO A SINGLE CAUSAL FACTOR: SYSTEM DESIGNERS OVER-LOOKED THE FACT THAT THEIR PRODUCT MUST BE OPERATED BY HUMANS--DIFFICULT TO TRAIN AND, MORE IMPORTANTLY, BE KEPT TRAINED, AND, IN SOME CASES, EVEN UNTRAINABLE. SYSTEMS WHICH MANIFEST SUCH SYMPTOMS OF MALFUNCTION USUALLY HAVE ONE THING IN COMMON: THE IMPORTANCE OF HUMAN FACTORS IN THE BASIC DESIGN OF TERMINAL DEVICES AND, PERHAPS, IN THE OPERATING PROCEDURES REQUIRED BY THE COMPUTER SYSTEM, HAS BEEN OVERLOOKED.

# 2P, OR.

THIS PAPER PRESENTS A VERY PESSIMISTIC AND CONSERVATIVE VIEW OF TERMINAL DESIGN. A BASIC THESIS IS THAT THE DESIGNER SHOULD CONSIDER THE ULTIMATE USERS TO BE ESSENTIALLY UNTRAINABLE. THIS IS CLEARLY AT ONE EXTREME; AT THE OTHER EXTREME IS DESIGNING TERMINALS ON THE BASIS ONLY OF HARDWARE AND SOFTWARE CONSIDERATIONS. BOTH EXTREMES HAVE DISADVANTAGES, BUT THE LATTER EXTREME IS USED MUCH MORE FREQUENTLY THAN THE FIRST AND THE ASSOCIATED UNDESIRABLE CONSEQUENCES ARE WELL KNOWN. CLEARLY, THERE ARE TRADE-OFFS BETWEEN THESE TWO VIEWPOINTS AND SOME COMPROMISE WOULD BE, FOR MOST APPLICATIONS, MORE APPROPRIATE.

59 GUIDELINES FOR DISPLAY DESIGN AND EVALUATION
BURNETTE, K.T. EVALUATING THE MAN-DISPLAY INTERFACE. THE ELECTRONIC ENGINEER,
JULY 1972, 31(7), PP. 64; 66-67.
DESCRIPTION:

DISPLAY MECHANIZATION HAS ADVANCED RAPIDLY, WITH THE MOST RECENT GAIN THE FLEXIBLE FORMAT ELECTRONIC DISPLAY. BY CONTRAST, PROGRESS TO DETERMINE THE MOST EFFECTIVE INFORMATION PRESENTATION FORM AT THE MAN-DISPLAY INTERFACE HAS BEEN VERY SLOW. ONE TECHNIQUE TO SOLVE THE INTERFACE PROBLEM HAS BEEN THE DEVELOPMENT OF "DISPLAY QUALITY FACTORS," WHICH DESCRIBE THE OVERALL VISUAL PERFORMANCE QUALITIES OF DISPLAYS. IN GENERAL, THESE QUALITY FACTORS ARE HIGHLY COMPLEX FUNCTIONS OF BOTH THE HUMAN PERCEPTION AND THE DISPLAY ENVIRONMENT. THE QUALITY FACTORS CONSIDERED IN THIS PAPER ARE FLICKER, DISPLAY ELEMENT RESOLUTION, VISUAL ACUITY, AND CONTRAST-LUMINANCE REQUIREMENTS. ALSO AFFECTING THE CHOICE OF A DISPLAY, AND ALSO CONSIDERED, ARE FACTORS INVOLVING LEGIBILITY, INFORMATION CODING, AND SIZE WHICH CAN VARY GREATLY WITH THE INDIVIDUAL SITUATION AND MUST BE HANDLED STATISTICALLY. (A, ABBR.)
3P, DR.

COMMENTS:

THIS BRIEF PAPER PROVIDES A FAIRLY ADEQUATE DISCUSSION OF SOME GUIDELINES FOR PHYSICAL PROPERTIES OF CRT DISPLAYS. THERE IS NO DISCUSSION, HOWEVER, OF THE CONSEQUENCES TO BE EXPECTED IF THESE GUIDELINES ARE NOT FOLLOWED. SUFFICIENT RESEARCH HAS BEEN DONE SO THAT IT IS FAIRLY STRAIGHTFORWARD TO PRESENT ACCURATE GUIDELINES FOR SUCH PHYSICAL PROPERTIES AS FLICKER, BRIGHTNESS, ETC. POSTULATING GUIDELINES FOR SUCH PROPERTIES AS DISPLAY FORMAT, INTERACTION LANGUAGE, ETC., HOWEVER, IS MUCH MORE DIFFICULT AND IS NOT CONSIDERED IN THIS PAPER.

60 INTERACTIVE WARGAMING

BURSKY, P., CHURCHILL, W.H., LULL, B.E., WAGSTAFF, E.B., & PRYWES, N.S. A MAN-MACHINE COMPETITIVE GAME: A NAVAL DUEL (TECHNICAL REPORT 68-34). PHILADELPHIA, PENNSYLVANIA: UNIVERSITY OF PENNSYLVANIA, MOORE SCHOOL OF ELECTRICAL ENGINEERING, MAY 1968. (NTIS NO. AD 671911) DESCRIPTION:

THE WORK REPORTED HEREIN CONCERNS A GAME WHEREBY TWO COMPETING PLAYERS ARE GIVEN AID INTERACTIVELY BY A LARGE SCALE COMPUTER. A NAVAL WAR GAME IS USED AS THE VEHICLE IN THIS RESEARCH, THE PRIMARY OBJECTIVE OF WHICH IS TO DEVELOP AN UNDERSTANDING AND A METHODOLOGY USING ON-LINE COMPUTERS. BY USING THE GAME'S ENVIRONMENT, EXPERIMENTS WITH METHODS FOR INTERACTIVE AND REALTIME COMMUNICATIONS BETWEEN USER AND COMPUTER IN COMPLEX PROBLEM SOLVING ARE DEMONSTRATED AND ANALYZED. IT IS RECOMMENDED THAT THE NAVY TAKE NOTE OF THIS NEW METHODOLOGY WHICH COULD HAVE POTENTIALLY GREAT INFLUENCE ON THE DEVELOPMENT OF TACTICS, THE TRAINING OF OFFICERS AND THE DEVELOPMENT OF INTEGRATED CONTROL SYSTEMS FOR NAVAL VESSELS.

THIS RESEARCH DEMONSTRATES HOW A USER DEFINES INFORMATION MODULES, MANIPULATES THEM AND SELECTIVELY USES THEM AS BUILDING BLOCKS FIRST FOR LARGER MODULES AND ULTIMATELY FOR THE SOLUTION OF A PROBLEM. THE COMPUTER IS USED AS A REPOSITORY FOR ALL DATA ACCRUED IN THE GAME; THIS ACCUMULATED INFORMATION IS ALWAYS AVAILABLE TO A PLAYER. BECAUSE THE GAME USES AN ON-LINE COMPUTER SYSTEM TO SIMULATE THE REAL LIFE ENVIRONMENT, THE PLAYERS CAN REQUEST COMPUTER COMPUTATIONS AT ANY TIME AND EXPECT RESPONSES ALMOST IMMEDIATELY. (A)

116P, 5R.

THE SYSTEM DESCRIBED IN THIS PAPER OFFERS GREAT POTENTIAL BOTH FOR TRAINING NAVAL OFFICERS AND FOR INVESTIGATING INTERACTIVE PROBLEM-SOLVING BEHAVIOR. A COMPUTER IS USED TO SIMULATE A REAL-LIFE ENVIRONMENT, CARRY OUT COMMANDS, STORE INFORMATION THAT THE GAME PLAYERS FEEL IS RELEVANT, AND RECORD THE PLAYER'S BEHAVIOR FOR LATER ANALYSIS. THIS SYSTEM PROVIDES A FAIRLY ACCURATE SIMULATION OF A REAL-WORLD ENVIRONMENT AND, HENCE, PROVIDES A GOOD TRAINING DEVICE. THIS SYSTEM COULD, HOWEVER, BE USED MORE EFFECTIVELY

FAIRLY ACCURATE SIMULATION OF A REAL-WORLD ENVIRONMENT AND, HENCE, PROVIDES A GOOD TRAINING DEVICE. THIS SYSTEM COULD, HOWEVER, BE USED MORE EFFECTIVELY ALTHOUGH THIS SYSTEM ALLOWS A NAVAL OFFICER TO PRACTICE PROBLEM SOLVING IN A TACTICAL SITUATION, IT DOES NOT CURRENTLY PROVIDE PROBLEM-SOLVING AIDS. SINCE THIS SYSTEM ACCURATELY SIMULATES A REAL-WORLD ENVIRONMENT, ANY AID DEVELOPED FOR THIS SYSTEM COULD EASILY BE IMPLEMENTED IN AN ACTUAL COMMAND AND CONTROL SYSTEM. THE USEFULNESS OF THIS SYSTEM AS A VEHICLE FOR INVESTIGATING INTERACTIVE PROBLEM SOLVING BEHAVIOR AND FOR EXPERIMENTING WITH VARIOUS TYPES OF PROBLEM-SOLVING AIDS IS NOT FULLY EXPLORED IN THIS PAPER.

61 DESIGN CONSIDERATIONS FOR BIBLIOGRAPHIC SYSTEM
CADWALLADER, G. FUNCTIONAL AND SOFTWARE CONSIDERATIONS FOR BIBLIOGRAPHIC DATA
BASE UTILIZATION (TECHNICAL REPORT 1582-100-TR-4). PHILADELPHIA,
PENNSYLVANIA: AUERBACH CORP., MAY 1969. (NTIS NO. PB 183816)
DESCRIPTION:

THE PURPOSE OF THIS REPORT IS TO DESCRIBE THE GENERAL FUNCTIONAL AND SOFTWARE REQUIREMENTS OF A NATIONAL AGRICULTURAL LIBRARY SYSTEM USING EXTERNAL SOURCES OF BIBLIOGRAPHIC DATA. THE FUNCTIONAL AND SOFTWARE REQUIREMENTS OF THE SYSTEM TO BE IMPLEMENTED WILL DEPEND ON VARIOUS SYSTEM DESIGN DECISIONS WHICH MUST BE MADE PRIOR TO THE DEVELOPMENT OF DETAILED SOFTWARE SPECIFICATIONS AND AN IMPLEMENTATION. HOWEVER, VARIOUS SYSTEM DESIGN ALTERNATIVES ARE OUTLINED IN THIS REPORT. USER REQUIREMENTS ARE ALSO DISCUSSED.

ALTHOUGH PRELIMINARY CONCLUSIONS AND SUGGESTIONS ARE PRESENTED, THE OVERALL PURPOSE OF THE COMPARISON OF DESIGN ALTERNATIVES PRESENTED IN THIS REPORT IS TO CONVEY A GENERAL INSIGHT INTO THE CONSIDERATIONS AND CRITERIA INVOLVED IN MAKING SYSTEM DESIGN DECISIONS. WE BELIEVE THAT THIS APPROACH WILL PROVIDE A FIRM AND LOGICALLY STRUCTURED FOUNDATION FOR SUBSEQUENT ANALYSIS AND DESIGN EFFORTS. (A, ABBR.) 49P, DR.

### COMMENTS:

THIS PAPER PROVIDES A FAIRLY THOROUGH DISCUSSION OF THE HARDWARE AND SOFTWARE REQUIREMENTS FOR A BIBLIOGRAPHIC RETRIEVAL SYSTEM AND DESCRIBES SOME OF THE PROBLEMS TO BE EXPECTED WHEN DEALING WITH LARGE DATA BASES. THE DISCUSSION OF USER REQUIREMENTS, HOWEVER, IS NOT ENTIRELY SATISFACTORY. THE AUTHOR APPEARS TO CONFUSE THE DEFINITION OF USER REQUIREMENTS WITH THE DEFINITION OF HARDWARE AND SOFTWARE REQUIREMENTS. THAT IS, USER REQUIREMENTS DEFINITION IS STRUCTURED AROUND TECHNOLOGICAL CONSIDERATIONS RATHER THAN BEING CONSIDERED INDEPENDENTLY AND IN CLOSE COOPERATION WITH THE POTENTIAL USERS OF THE SYSTEM. SUCH AN APPROACH CAN, OF COURSE, SEVERELY LIMIT USER ACCEPTANCE AND SYSTEM EFFECTIVENESS.

62 FORMATTING OF TACTICAL DISPLAYS
CALLAN, J.R., CURRAN, L.E., & LANE, J.L. VISUAL SEARCH TIMES FOR NAVY TACTICAL
INFORMATION DISPLAYS (REPORT NO. NPRDC-TR-77-32). SAN DIEGO, CALIFORNIA: NAVY
PERSONNEL RESEARCH AND DEVELOPMENT CENTER, MAY 1977. (NTIS NO. AD A040543)
DESCRIPTION:

AN EXPERIMENT WAS CONDUCTED TO DETERMINE THE TIME AND ACCURACY WITH WHICH AN OPERATOR COULD FIND TARGET ITEMS IN EACH OF SIX PREFORMATTED INFORMATION DISPLAYS. THE DISPLAYS CORRESPOND TO TWO VERSIONS (LONG AND SHORT) OF THREE CRT FORMATS PROPOSED FOR THE NAVAL TACTICAL DATA SYSTEM (NTDS). THE NUMBER OF ITEMS ON THE DISPLAYS RANGED FROM 6 TO 40.

OPERATORS WERE ASKED TO RETAIN EITHER A TWO- OR FOUR-CONSONANT LETTER SET IN MEMORY DURING THE SEARCH TASK. FOLLOWING A FIXED TIME TO PERFORM THE SEARCH, SINGLE LETTER PROBES WERE PRESENTED TO DETERMINE THAT THE MEMORY SET HAD BEEN MAINTAINED.

REACTION TIMES TO THE SEARCH TASK INCREASED AS THE NUMBER OF ITEMS IN THE DISPLAY INCREASED, BUT SEARCH TIMES WERE NOT INFLUENCED BY THE CONCURRENT MEMORY TASK. REACTION TIMES TO THE MEMORY PROBE REVEALED FASTER RESPONSE TO THE TWO-LETTER SET THAN TO THE FOUR-LETTER SET. THERE WERE NO SIGNIFICANT AFFECTS ATTRIBUTABLE TO PRACTICE, RELATIVE DISPLAY SCREEN LOCATION, OR INTERACTIONS BETWEEN THE MEMORY TASK AND THE DISPLAY SEARCH.

TOTAL AMOUNT OF INFORMATION ON THE DISPLAY WAS, THEREFORE, THE ONLY RELEVANT FACTOR OF THOSE EXAMINED. FURTHER EFFORT SHOULD BE CONCENTRATED ON DIFFERENT SEARCH REQUIREMENTS, SCAN PATTERNS, DISPLAY AREA SEGREGATION, AND PRACTICE OR OPERATOR SKILL LEVEL. (A) 19P, 12R.

### COMMENTS:

THIS PAPER DESCRIBES A FAIRLY STRAIGHTFORWARD EXPERIMENT. THERE IS SOME QUESTION, HOWEVER, WHETHER THE FINDING, THAT NUMBER OF ITEMS BUT NOT DISPLAY FORMAT AFFECT PERFORMANCE IN A SEARCH TASK, WOULD GENERALIZE TO AN OPERATIONAL SETTING. THE FORMATS EXAMINED WERE DESIGNED FOR THE NAVAL TACTICAL DATA SYSTEM. THESE DISPLAYS MAKE EXTENSIVE USE OF ABBREVIATIONS AND MNEWONICS. TO AN EXPERIENCED OPERATOR, ONE GROUPING OF ITEMS MAY MATCH HIS OR HER PERCEPTION OF THE TASK AND, THUS, AID IN SEARCHING FOR A SPECIFIC ITEM, MORE THAN ANOTHER GROUPING OR FORMAT. FORMAT DIFFERENCES THAT SIGNIFICANTLY AFFECT THE PERFORMANCE OF EXPERIENCED OPERATORS MAY, THEREFORE, HAVE NO AFFECT WHEN NOVICE SUBJECTS ARE USED, AS IS THE CASE IN THIS STUDY. THIS HIGHLIGHTS THE IMPORTANCE OF CAREFULLY CONSIDERING THE SELECTION OF A SUBJECT SAMPLE POPULATION FOR EMPIRICAL RESEARCH.

63 MODEL OF MAN-COMPUTER INTERACTION
CARBONELL, J.R. ON MAN-COMPUTER INTERACTION: A MODEL AND SOME RELATED
ISSUES (BBN REPORT NO. 1593). CAMBRIDGE, MASSACHUSETTS: BOLT BERANEK AND
NEWMAN, INC., SEPTEMBER 1967 (ALSO REPORTED MORE BRIEFLY IN IEEE TRANSACTIONS
ON SYSTEM SCIENCE AND CYBERNETICS, 1969, SSC-5, 16-26). (NTIS NO. AD 666666)
DESCRIPTION:

A SURVEY OF THE LITERATURE RELATED TO MAN-COMPUTER INTERACTION REVEALS THE MANY ASPECTS OF THIS PROBLEM, WHICH APPEARS TO BE IN THE CROSSROADS AMONG SUCH DIVERSE FIELDS AS COMPUTER LANGUAGES, COMPUTER SYSTEMS OPERATIONAL CHARACTERISTICS, CONTROL THEORY, DECISION THEORY, INFORMATION THEORY, APPLIED PSYCHOLOGY, COMPUTER DISPLAY, AND INTERFACE ENGINEERING, ETC. IN THIS PAPER WE HAVE CHOSEN TO PRESENT THE ON-LINE INTERACTION FROM AN INFORMATION AND DECISION POINT OF VIEW. AFTER A BRIEF DISCUSSION OF CLASSES OF ON-LINE SITUATIONS AND TASKS, WE PROPOSE A MODEL OF THE CASE IN WHICH A HUMAN OPERATOR IS ENGAGED ON-LINE IN THE SOLUTION OF A PROBLEM LIKE DEBUGGING A PROGRAM, TESTING A MODEL IN A SCIENTIFIC APPLICATION, OR PERFORMING A LIBRARY SEARCH. IN THIS MGDEL THE HUMAN OPERATOR IS CONSIDERED TO SEEK TO MINIMIZE OVERALL COST. THIS COST IS OBTAINED BY ADDING THE OPERATIONAL COST OF BOTH MAN AND COMPUTER TO A REMNANT TERMINAL COST ORIGINATED BY THE REMAINING UNCERTAINTY. THIS ANALYSIS, PERFORMED FOR EACH OF A SET OF POSSIBLE ALTERNATIVES FOR ACTION, MAY LEAD (THE USER) TO SELECT AND EXECUTE ONE OF THEM, TO TERMINATE THE PROCESS, OR TO RE-EVALUATE THE POSSIBLE ALTERNATIVES AND/OR HYPOTHESES IN A SEARCH FOR NEW ONES. SOME PRACTICAL APPLICATIONS IN TERMS OF RESPONSE TIME AND OTHER CHARACTERISTICS OF A COMPUTER UTILITY ARE PRESENTED, AS WELL AS SOME THEORETICAL IMPLICATIONS FROM AN INFORMATIONAL POINT OF VIEW. (A) 37P, 34R.

COMMENTS:

THIS PAPER FOCUSES ON INTERACTIONS IN WHICH THE HUMAN IS IN CONTROL AND MAKES DECISIONS BASED ON INFORMATION STORED IN THE COMPUTER. THIS DEFINITION SEEMS APPROPRIATE FOR MANY TYPES OF INTERACTIVE TASKS. THAT IS, A MAJOR COMPONENT OF INTERACTIVE TASKS IS INFORMATION RETRIEVAL. THIS PAPER PRESENTS A QUANTITATIVE PROCESS MODEL OF MAN-COMPUTER INTERACTION THAT IS BASED ON MAN'S INFORMATION PROCESSING AND DECISION MAKING ACTIVITIES. THIS MODEL PROVIDES A FRAMEWORK FOR UNDERSTANDING AND INTEGRATING THEORETICAL AND EMPIRICAL INVESTIGATIONS OF MAN-COMPUTER INTERACTION. ALTHOUGH THIS MODEL IS SOMEWHAT DATED, DUE TO MORE RECENT THEORETICAL DEVELOPMENTS IN HUMAN INFORMATION PROCESSING, IT DOES CONTAIN MANY WORTHWHILE IDEAS AND COULD BE USED AS A BASIS FOR DEVELOPING MORE UP-TO-DATE MODELS.

## 64 NATURAL-LANGUAGE DIALOGUE

CARBONELL, J.R. MIXED-INITIATIVE MAN-COMPUTER INSTRUCTIONAL DIALOGUES (REPORT NO. 1971). CAMBRIDGE, MASSACHUSETTS: BOLT BERANEK AND NEWMAN, INC., MAY 1970. (NTIS NO. AD 707782)
DESCRIPTION:

THE MAIN PURPOSE OF THE RESEARCH REPORTED IN THIS DOCUMENT IS TO SHOW THAT A NEW TYPE OF COMPUTER-ASSISTED INSTRUCTION (CAI), IN MANY RESPECTS MORE POWERFUL THAN EXISTING ONES, IS FEASIBLE, AND TO DEMONSTRATE BY EXAMPLE SOME OF ITS MAJOR CAPABILITIES. IN ORDER TO DO THAT, A SET OF COMPUTER PROGRAMS, THE SCHOLAR SYSTEM, WAS WRITTEN. BOTH THE CONCEPTION AND THE IMPLEMENTATION OF THIS SYSTEM ARE DISCUSSED IN DETAIL. ACTUAL ON-LINE PROTOCOLS OF THE USAGE OF SCHOLAR ARE INCLUDED. THE PRESENT APPROACH TO CAI CAN BE DEFINED AS BEING INFORMATION—STRUCTURE—ORIENTED (ISO) BECAUSE IT IS BASED ON THE UTILIZATION OF A SYMBOLIC INFORMATION NETWORK OF FACTS, CONCEPTS, AND PROCEDURES. SCHOLAR IS CAPABLE TO GENERATE OUT OF ITS INFORMATION NETWORK THE MATERIAL TO BE PRESENTED TO THE STUDENT, THE QUESTIONS TO BE ASKED TO HIM, AND THE CORRESPONDING EXPECTED ANSWERS. SCHOLAR CAN ALSO UTILIZE ITS INFORMATION NETWORK TO ANSWER QUESTIONS FORMULATED BY THE STUDENT. AS A CONSEQUENCE, SCHOLAR IS CAPABLE OF MAINTAINING A MIXED-INITIATIVE DIALOGUE WITH THE STUDENT. THIS DIALOGUE TAKES PLACE IN A RATHER COMFORTABLE SUBSET OF ENGLISH. (A) 211P, 45R.

#### COMMENTS:

THIS PAPER DESCRIBES THE RATIONALE UNDERLYING THE DEVELOPMENT OF SCHOLAR AND PROVIDES A FAIRLY DETAILED ACCOUNT OF THIS DEVELOPMENT. A BRIEFER DESCRIPTION OF SCHOLAR AND SOME INTERESTING EXTENSIONS ARE PRESENTED BY A. COLLINS, E.H. WARNOCK, AND J.J. PASSAFIUME (1974). ALTHOUGH SCHOLAR IS PRIMARILY A VEHICLE FOR RESEARCH IN COMPUTER-ASSISTED INSTRUCTION, THE CONCEPT OF A MIXED-INITIATIVE DIALOGUE COULD BE USEFUL IN A VARIETY OF INTERACTIVE SETTINGS AND THE NATURAL-LANGUAGE DIALOGUE HANDLING PROCEDURES COULD BE APPLIED TO ALMOST ANY LIMITED-DISCOURSE DOMAIN.

# 65 MAN-COMPUTER DIALOGUE

CARBONELL, J.R. ARTIFICIAL INTELLIGENCE AND LARGE INTERACTIVE MAN COMPUTER SYSTEMS. CAMBRIDGE, MASSACHUSETTS: BOLT BERANEK AND NEWMAN, INC., JULY 1971. (NTIS NO. AD 726441) DESCRIPTION:

THIS PAPER REPORTS ON SCHOLAR, THE FIRST PROTOTYPE SYSTEM CAPABLE OF TRUE MIXED-INITIATIVE MAN-COMPUTER DIALOGUE ON A GIVEN TOPIC. THE COMPUTER IS NOT ONLY CAPABLE OF ANSWERING QUESTIONS FROM THE MAN (BOTH USING A COMFORTABLE AND NOT TOO RESTRICTED SUBSET OF ENGLISH), BUT ALSO OF GENERATING QUESTIONS, ANALYZING THE MAN'S RESPONSES, AND PRODUCING REASONABLE CONSEQUENT ACTIONS. ALL THIS OCCURS WITHOUT FULL ANTICIPATION OF CONVERSATIONAL ITEMS AND SEQUENCES. A VERY POWERFUL PROGRAM, APPLICABLE TO MANY SUBJECT MATTERS, ACTS UPON A HIGHLY STRUCTURED DATA BASE TO GENERATE THE COMPUTER ANSWERS, AND QUESTIONS, TO EVALUATE THE MAN'S ANSWERS, AND TO PRODUCE SUITABLE ACTION SEQUENCES.

IN THIS PAPER, WE REPORT ON RECENT ADDITIONS LIKE AN IMPROVED INFERENCE-MAKING CAPABILITY, MORE FLEXIBLE HANDLING OF NATURAL LANGUAGE, AND ESPECIALLY, A NEW SOPHISTICATED GRAPHIC CAPABILITY. (A) 25P, 5R.

# COMMENTS:

THIS IS A CONCISE, EASILY READ DESCRIPTION OF SCHOLAR, A MIXED-INITIATIVE, GENERATIVE COMPUTER-ASSISTED-INSTRUCTION (CAI) SYSTEM. ALTHOUGH SCHOLAR IS PRIMARILY A VEHICLE FOR RESEARCH IN CAI, THE CONCEPT OF A MIXED-INITIATIVE DIALOGUE COULD BE USEFUL IN A VARIETY OF INTERACTIVE SITUATIONS AND THE NATURAL-LANGUAGE HANDLING PROCEDURES COULD BE APPLIED TO ALMOST ANY DOMAIN OF DISCOURSE. OF PRIMARY INTEREST IN THIS PAPER IS THE DISCUSSION OF GRAPHICAL CAPABILITIES. THE SUGGESTION THAT GRAPHICAL DIALOGUES CAN BE HANDLED IN A MANNER VERY SIMILAR TO THAT OF NATURAL-LANGUAGE DIALOGUES MAY PROVE QUITE USEFUL. A MORE DETAILED DISCUSSION OF SCHOLAR IS PRESENTED IN J.R. CARBONELL (1970) AND OTHER EXTENSIONS TO THE BASIC CONCEPT ARE PRESENTED BY A. COLLINS, E.H. WARNOCK, AND J.J. PASSAFINNE (1974).

66 NATURAL-LANGUAGE DIALOGUE

CARBONELL, J.R., & COLLINS, A.M. MIXED-INITIATIVE SYSTEMS FOR TRAINING AND DECISION-AID APPLICATIONS (TECHNICAL REPORT ESD-TR-70-373). L.G. HANSOM FIELD, BEDFORD, MASSACHUSETTS: ELECTRONIC SYSTEMS DIVISION, NOVEMBER 1970. (NTIS NO. AD 718977)

THE PROJECT REPORTED IN THIS DOCUMENT DESCRIBES SCHOLAR, THE FIRST PROTOTYPE SYSTEM CAPABLE OF A TRUE MIXED-INITIATIVE MAN-COMPUTER DIALOGUE ON A GIVEN TOPIC. THE COMPUTER IS NOT ONLY CAPABLE OF ANSWERING QUESTIONS FROM THE MAN (BOTH USING A COMFORTABLE AND NOT TOO RESTRICTED SUBSET OF ENGLISH), BUT ALSO OF GENERATING QUESTIONS, ANALYZING THE MAN'S RESPONSES, AND PRODUCING REASONABLE CONSEQUENT ACTIONS. ALL THIS OCCURS WITHOUT FULL ANTICIPATION OF CONVERSATIONAL ITEMS AND SEQUENCES. A VERY POWERFUL PROGRAM, APPLICABLE TO MANY SUBJECT MATTERS, ACTS UPON A HIGHLY STRUCTURED DATA BASE TO GENERATE THE COMPUTER ANSWERS AND QUESTIONS, TO EVALUATE THE MAN'S ANSWERS, AND TO PRODUCE SUITABLE ACTION SEQUENCES.

THE ENVIRONMENT SELECTED TO DEVELOP SCHOLAR IS IN THE FIELD OF TRAINING. SCHOLAR HAS BEEN IMPLEMENTED AS A NEW TYPE OF COMPUTER-ASSISTED INSTRUCTION (CAI) WHICH RESULTS IN WHAT WE CAN CALL INFORMATION-STRUCTURE-ORIENTED (ISO) CAI SYSTEMS. SOME OF THE MAJOR FEATURES OF ISO SYSTEMS ARE (1) THEY PERMIT MIXED-INITIATIVE DIALOGUE, (2) THE DIALOGUE TAKES PLACE IN A COMFORTABLE SUBSET OF ENGLISH, (3) THE INSTRUCTIONAL PROGRAMMER NEED NOT SPECIFY IN ADVANCE ALL THE QUESTIONS, RESPONSES, AND BRANCHINGS THAT MAY OCCUR, AND (4) THE MIXED-INITIATIVE CAPABILITIES CAN BE UTILIZED TO PERFORM OTHER TASKS, SUCH AS THAT OF AN ON-LINE DECISION AID.

THIS DOCUMENT COVERS BOTH THE THEORY SUPPORTING SCHOLAR AND ITS IMPLEMENTATION. ACTUAL ON-LINE PROTOCOLS ARE USED TO ILLUSTRATE THE MAIN FEATURES OF THE SYSTEM. (A, ABBR.) 126P, 47R.

COMMENTS:

THIS PAPER PRESENTS ESSENTIALLY THE SAME INFORMATION AS THAT CONTAINED IN A PAPER BY J.R. CARBONELL (1970), IN A SOMEWHAT BRIEFER FORM.

67 EFFECT OF SYSTEM RESPONSE TIME ON USER
CARBONELL, J.R., ELKIND, J.I., & NICKERSON, R.S. ON THE PSYCHOLOGICAL
IMPORTANCE OF TIME IN A TIME SHARING SYSTEM. HUMAN FACTORS, 1968, 10, 135-142
(ALSO: REPORT NO. SCIENTIFIC-6, BBN-1687. CAMBRIDGE, MASSACHUSETTS: BOLT
BERANEK AND NEWMAN, INC., SEPTEMBER 1967). (NTIS NO. AD 670604)
DESCRIPTION:

ONE OF THE MOST IMPORTANT PROBLEMS IN THE DESIGN AND/OR OPERATION OF A COMPUTER UTILITY IS TO OBTAIN DYNAMICAL CHARACTERISTICS THAT ARE ACCEPTABLE AND CONVENIENT TO THE ON-LINE USER. THIS PAPER IS CONCERNED WITH THE PROBLEMS OF ACCESS TO THE COMPUTER UTILITY, RESPONSE TIME AND ITS EFFECT UPON CONVERSATION'L USE OF THE COMPUTER, AND THE EFFECTS OF LOAD ON THE SYSTEM. PRIMARY ATTENTION IS PLACED UPON RESPONSE TIME: RATHER THAN A SINGLE MEASURE, A SET OF RESPONSE TIMES SHOULD BE MEASURED IN A GIVEN COMPUTER UTILITY, IN CORRESPONDENCE TO THE DIFFERENT TYPES OF OPERATIONS REQUESTED. IT IS ASSUMED THAT THE PSYCHOLOGICAL VALUE OF SHORT RESPONSE TIME STEMS FROM A SUBJECTIVE COST MEASURE OF THE USER'S DWN TIME, LARGELY INFLUENCED BY THE VALUE OF CONCURRENT TASKS BEING POSTPONED. A MEASURE OF COST (TO THE INDIVIDUAL AND/OR HIS ORGANIZATION) OF THE TIME-ON-LINE REQUIRED TO PERFORM A TASK MIGHT THUS BE DERIVED. MORE SUBTLE IS THE PROBLEM OF THE USER'S ACCEPTABILITY OF GIVEN RESPONSE TIMES. THIS ACCEPTABILITY IS A FUNCTION OF THE SERVICE REQUESTED (E.G., LENGTH OF COMPUTATION), AND VARIABILITY WITH RESPECT TO EXPECTATIONS DUE BOTH TO UNCERTAINTY IN THE USER'S ESTIMATION AND TO VARIATIONS IN THE RESPONSE TIME ORIGINATED BY VARIABLE LOADS ON THE SYSTEM. AN EFFORT SHOULD BE MADE BY COMPUTER-UTILITY DESIGNERS TO INCLUDE DYNAMIC CHARACTERISTICS (SUCH AS PREDICTION OF LOADS AND THEIR EFFECTS) AMONG THEIR DESIGN SPECIFICATIONS. (A)

COMMENTS:

THIS PAPER CONTAINS A FAIRLY GENERAL DISCUSSION OF THE EFFECTS OF ACCESSIBILITY AND RESPONSE TIME ON ACCEPTANCE OF A TIME-SHARING SYSTEM BY ITS USERS. IT THEN PROPOSES A GENERAL APPROACH TO THE QUANTITATIVE MODELING OF THESE RELATIONSHIPS. THE FORM OF SUCH A MODEL IS PRESENTED, AND SOME CENERAL IDEAS FOR ITS EXPERIMENTAL DEVELOPMENT ARE SUGGESTED. IT IS INTERESTING TO NOTE HOW READILY THIS MODEL MIGHT FIT INTO THE RESPONSE SURFACE METHODOLOGY DEVELOPED LATER BY R.C. WILLIGES AND OTHERS (SEE SPECIAL ISSUE OF HUMAN FACTORS, AUGUST 1973). THE PRINCIPAL DIFFICULTY WITH A MODEL SUCH AS THAT PROPOSED HERE IS THE FACT THAT RESPONSE TIME ACCEPTABILITY VARIES SO MUCH WITH THE PARTICULAR TASK BEING PERFORMED, AND THERE ARE SO MANY KINDS OF TASKS, THAT THE MODEL MUST HAVE VERY HIGH DIMENSIONALITY. SEE R.B. MILLER (1968) FOR AN EXCELLENT DISCUSSION OF THE RESPONSE-TIME/TASK RELATIONSHIP. SECONDARILY, IT IS SOMEWHAT DIFFICULT TO MEASURE USER ACCEPTABILITY SATISFACTORILY. TO OUR KNOWLEDGE, THE MODEL PROPOSED HERE HAS NOT BEEN PURSUED, PROBABLY FOR THESE REASONS. THE PAPER SHOULD BE USEFUL TO THOSE INTERESTED IN MODELING USER BEHAVIOR, HOWEVER.

#### 68 INPUT DEVICES

CARD, S.K., ENGLISH, W.K., & BURR, B.J. EVALUATION OF MOUSE, RATE-CONTROLLED ISOMETRIC JOYSTICK, STEP KEYS, AND TEXT KEYS FOR TEXT SELECTION ON A CRT. (TECHNICAL REPORT), PALO ALTO, CALIFORNIA: XEROX PALO ALTO RESEARCH CENTER, UNDATED.

#### DESCRIPTION:

FOUR DEVICES ARE EVALUATED WITH RESPECT TO HOW RAPIDLY THEY CAN BE USED TO SELECT TEXT ON A CRT DISPLAY. THE MOUSE IS FOUND TO BE FASTEST ON ALL COUNTS AND ALSO TO HAVE THE LOWEST ERROR RATES. IT IS SHOWN THAT VARIATIONS IN POSITIONING TIME WITH THE MOUSE AND JOYSTICK ARE ACCOUNTED FOR BY FITTS'S LAW. IN THE CASE OF THE MOUSE, THE MEASURED FITTS'S LAW SLOPE CONSTANT IS CLOSE TO THAT FOUND IN OTHER EYE-HAND TASKS LEADING TO THE CONCLUSION THAT POSITIONING TIME WITH THIS DEVICE IS ALMOST THE MINIMAL ACHIEVABLE. POSITIONING TIME FOR THE KEY DEVICES IS SHOWN TO BE PROPORTIONAL TO THE NUMBER OF KEYSTROKES WHICH MUST BE TYPED. (A) 37P, 14R.

#### COMMENTS:

THE EXPERIMENT REPORTED IN THIS PAPER APPEARS TO HAVE BEEN CAREFULLY CONTROLLED AND IT IS CLEARLY PRESENTED. TWO POINTS SHOULD BE KEPT IN MIND WHEN CONSIDERING THE RESULTS OF THIS EXPERIMENT. FIRST, WITHIN A GIVEN CLASS OF INPUT DEVICE THERE CAN BE SEVERAL TYPES. THUS, THE REPORTED RESULTS APPLY ONLY TO THE PARTICULAR JOYSTICK USED HERE, FOR EXAMPLE, AND MAY OR MAY NOT APPLY TO JOYSTICKS IN GENERAL. SECOND, EACH STIMULUS PRESENTATION BEGAN WITH THE SUBJECT DEPRESSING THE SPACE BAR ON THE KEYBOARD. THIS PROCEDURE CORRESPONDS, THEREFORE, TO ALTERNATING KEYBOARD ENTRY WITH TEXT SELECTION AND THE RESULTS MAY BE DIFFERENT IN A SIMPLE SELECTION TASK SUCH AS MENU SELECTION FOR COMMAND CONSTRUCTION. THE DISCUSSION OF FITTS'S LAW, WHICH IS USED HERE TO RELATE THE TIME REQUIRED FOR HAND MOVEMENTS TO TASK PROPERTIES, IS CLEARLY PRESENTED AND COULD BE USEFULLY APPLIED IN OTHER EVALUATIONS OF INPUT DEVICES. THIS PAPER IS PARTICULARLY VALUABLE BECAUSE IT ATTEMPTS TO INTEGRATE AND EXPLAIN ONE (TEMPORAL) ASPECT OF BEHAVIOR ACROSS A RANGE OF DEVICES, RATHER THAN MERELY PROVIDING DESCRIPTIVE INFORMATION.

#### 69 AUTOMATED MEDICAL INTERVIEWING

CARD, W.I., CREAN, G.P., EVANS, C.R., JAMES, B.W., NICHOLSON, M., WATKINSON, G., & WILSON, J. ON-LINE INTERROGATION OF HOSPITAL PATIENTS BY A TIME-SHARING TERMINAL WITH COMPUTER/CONSULTANT COMPARISON ANALYSIS. IN MAN-COMPUTER INTERACTION (PROCEEDINGS, CONFIRENCE ON MAN-COMPUTER INTERACTION, 2-4 SEPTEMBER 1970) (CONFERENCE PUBLICATION NO. 68). LONDON, ENGLAND: INSTITUTION OF ELECTRICAL ENGINEERS, 1970, 141-147.

AN IMPORTANT ASPECT OF MEDICAL EXAMINATION IS ELICITING INFORMATION ABOUT POSSIBLE DISEASES FROM THE PATIENT. IF THIS ASPECT OF CLINICAL MEDICINE CAN BE FORMALIZED, THEN AN INTERACTIVE COMPUTER SYSTEM COULD PERFORM THIS FUNCTION. IN THIS PAPER, WE WILL DESCRIBE SUCH A SYSTEM. THIS RESEARCH HAS TWO PURPOSES: (1) TO DETERMINE WHETHER INTERROGATION BY A COMPUTER IS ACCEPTABLE TO THE PATIENT, AND (2) TO COMPARE THE PRECISION WITH WHICH A COMPUTER CAN COLLECT EVIDENCE WITH THAT OF A HUMAN SPECIALIST.

#### COMMENTS:

THE INTERACTIVE SYSTEM DESCRIBED IN THIS PAPER IS PROGRAMMED TO ASK QUESTIONS. ALTHOUGH THE RESULTS OF AN EXPERIMENTAL ANALYSIS OF THIS SYSTEM ARE NOT REPORTED IN SUFFICIENT DETAIL TO EFFECTIVELY EVALUATE THIS SYSTEM (SEE W.I. CARD, M. NICHOLSON, ET AL, 1974, FOR A MORE DETAILED AND UP-TO-DATE ANALYSIS), IT SEEMS LIKELY THAT SUCH A SYSTEM COULD FUNCTION ADEQUATELY IN CONSTRAINED, WELL-STRUCTURED TASKS. THIS SYSTEM APPEARS TO BE A USEFUL FIRST STEP IN THE DEVELOPMENT OF COMPUTER-BASED INTERVIEWING SYSTEMS. AREAS IN WHICH ADDITIONAL RESEARCH IS PARTICULARLY NEEDED INCLUDE MORE NATURAL MAN-COMPUTER DIALOGUE AND MORE EFFECTIVE ASSIMILATION AND INTEGRATION OF THE INFORMATION ELICITED.

AUTOMATED MEDICAL INTERVIEWING

CARD, W.I., NICHOLSON, M., CREAN, G.P., WATKINSON, G., EVANS, C.R., WILSON,
J., & RUSSELL, D. A COMPARISON OF DOCTOR AND COMPUTER INTERROGATION OF
PATIENTS. INTERNATIONAL JOURNAL OF BIO-MEDICAL COMPUTING, 1974, 5, 175-187.
DESCRIPTION:

PATIENTS WERE INTERROGATED FOR THE PRESENCE OF GASTROINTESTINAL SYMPTOMS BY EITHER A DOCTOR-DOCTOR PAIR OR A DOCTOR-COMPUTER PAIR, IN EACH CASE INDEPENDENTLY. A STUDY WAS MADE OF THE ACCEPTABILITY OF COMPUTER INTERROGATION TO THE PATIENT AND THE ACCURACY OF THE RESPONSES ELICITED WAS MEASURED BY ESTIMATING THE ERRORS INCURRED BY DOCTOR AND BY COMPUTER USING A MODEL BASED ON INFORMATION THEORY. COMPUTER INTERROGATION WAS ACCEPTABLE TO THE MAJORITY OF PATIENTS BUT WAS LESS ACCURATE THAN DOCTOR INTERROGATION.

13P, 17R.

THIS PAPER PRESENTS AN EMPIRICAL EVALUATION OF A SIMPLE QUESTION-AND-ANSWER DIALOGUE FOR USE IN AUTOMATED MEDICAL INTERVIEWS. THE DIALOGUE IS SIMPLE, AND INVOLVES ONLY "YES," "NO," AND "?" PUSHBUTTON RESPONSES BY PATIENTS. THE AUTHORS ARGUE FAIRLY CONVINCINGLY THAT THIS DIALOGUE, AS WELL AS THE BASIC CONCEPT OF AUTOMATED INTERVIEWS, WAS ACCEPTED BY THE VAST MAJORITY OF THE 12 PATIENTS ON WHOM IT WAS TRIED. BASED ON A FAIRLY SOPHISTICATED STATISTICAL AND PROBABILISTIC ANALYSIS, THEY ALSO CONCLUDE THAT THE COMPUTER INTERVIEW TECHNIQUE HAD AN ERROR RATE NEARLY TWICE AS GREAT AS DID THE PHYSICIAN INTERROGATORS WITH WHOM THE TECHNIQUE WAS COMPARED. THEY ARGUE, HOWEVER, THAT THE LOWER COST, AND OTHER ADVANTAGES, OF THE AUTOMATED INTERVIEW MAY OFFSET THIS REDUCED ACCURACY. IT SEEMS POSSIBLE THAT FURTHER DEVELOPMENTS OF THIS DIALOGUE MIGHT INCREASE ITS EFFECTIVENESS, AND THAT IT MIGHT BE USEFUL FOR PRELIMINARY SCREENING EVEN IF ITS ERROR RATE IS OTHERWISE UNACCEPTABLE.

71 COMPARISON OF TERMINAL TYPES
CARLISLE, J.H. COMPARING BEHAVIOR AT VARIOUS COMPUTER DISPLAY CONSOLES IN
TIME-SHARED LEGAL INFORMATION (REPORT NO. P-4448). SANTA MONICA, CALIFORNIA:
RAND CORP., SEPTEMBER 1970. (NTIS NO. AD 712695)
DESCRIPTION:

THE OBJECTIVE OF THIS RESEARCH METHODOLOGY PROJECT IS TO EXAMINE THE MANMACHINE INTERACTION WHICH TAKES PLACE AT THE REMOTE CONSOLE OF A TIME-SHARED COMPUTER. AN ANALYTICAL TECHNIQUE UTILIZING A MULTIVARIATE DISCRIMINATE ANALYSIS IS EMPLOYED IN ORDER TO COMPARE BEHAVIOR AT DIFFERENT CONSOLES. FROM THIS DISCRIMINATE ANALYSIS, SOME CRITICAL DIFFERENCES BETWEEN CONSOLES ARE IDENTIFIED AND MEASURED. (A) 46P, 26R.

COMMENTS:

THIS IS A PRELIMINARY DRAFT OF A PAPER PRESENTED BY R.B. FETTER AND J.H. CARLISLE (1971).

72 MAN-COMPUTER DIALOGUE

CARLISLE, J.H. INTERACTIVE MAN-MACHINE COMMUNICATION: 1971 ANNUAL REPORT (TECHNICAL REPORT NO. 51). NEW HAVEN, CONNECTICUT: YALE UNIVERSITY, DEPARTMENT OF ADMINISTRATIVE SCIENCES, MARCH 1972. (NTIS NO. AD 740101) DESCRIPTION:

A FRAMEWORK FOR THE DESIGN AND INTERPRETATION OF EXPERIMENTS IN MAN-COMPUTER INTERACTION IS DESCRIBED. THE RESULTS OF EXPERIMENTS UTILIZING THE SYSTEM-USER BEHAVIOR MONITORING CAPABILITY DEVELOPED UNDER THIS RESEARCH ARE GIVEN, AND SPECIFIC DESIGN GUIDELINES PRESENTED. AUTOGRP, AN AUTOMATED SYSTEM FOR CLUSTERING DATA TO PRODUCE DECISION INFORMATION WAS USED IN THE CONTEXT OF PROBLEMS IN MEDICAL DECISION-MAKING IN THESE EXPERIMENTS. A TUTORIAL LANGUAGE, HELP, WAS DEVELOPED TO AID IN THE EXPERIMENTS AND IS DESCRIBED IN THIS REPORT. THIS LANGUAGE CAN BE USED TO DEVELOP TUTORIAL ASSISTANCE FOR ANY INTERACTIVE USE OF COMPUTERS. (A) 105P, 128R.

COMMENTS:

THIS PAPER CONSISTS OF THREE LOOSELY RELATED SECTIONS. THE FIRST SECTION DESCRIBES AN EXPERIMENTAL FRAMEWORK FOR MAN-COMPUTER INTERACTION RESEARCH. ALTHOUGH THIS FRAMEWORK DOES NOT SATISFY THE NEED FOR A COMPREHENSIVE, WELL UNDERSTOOD THEORETICAL FRAMEWORK TO GUIDE AND INTERPRET RESEARCH, IT DOES CONTAIN SEVERAL GOOD IDEAS. THOSE INTERESTED IN THIS FRAMEWORK ARE REFERRED TO J.H. CARLISLE (1974) FOR A MORE DETAILED DISCUSSION. THE SECOND SECTION IS BASED ON THE CORRECT PREMISE THAT MONITORING USER BEHAVIOR CAN PROVIDE VALUABLE INSIGHTS INTO DESIRED SYSTEM DESIGN FEATURES. A PRINCIPAL PROBLEM IS, OF COURSE, DETERMINING WHAT ASPECTS OF USER BEHAVIOR SHOULD BE OBSERVED AND THIS QUESTION IS NOT ADEQUATELY CONSIDERED IN THIS PAPER. THE THIRD SECTION DESCRIBES A PROGRAMMING LANGUAGE FOR INTERACTIVE DIALOGUES. AN INTERESTING FEATURE OF THIS LANGUAGE IS THAT ALL STATEMENTS SHARE A COMMON SYNTAX. THIS IS AN AREA THAT SHOULD BE INVESTIGATED FURTHER. WHILE A SINGLE SYNTACTIC STRUCTURE MAY SIMPLIFY LEARNING A LANGUAGE, IT MAY ALSO BE THE CASE THAT SYNTACTIC DIFFERENCES ARE AN IMPORTANT CUE IN RECOGNIZING DIFFERENT STATEMENT FUNCTIONS. THIS PAPER WOULD BE OF INTEREST TO THOSE CONCERNED WITH STUDYING MAN-COMPUTER INTERACTION AND WITH INTERFACE DESIGN.

PROTOCOL ANALYSIS FOR MAN-COMPUTER DIALOGUE DESIGN
CARLISLE, J.H. THE USE OF PROTOCOL ANALYSIS TO DESIGN MAN COMPUTER INTERACTION
PROGRAMS. IN J.H. CARLISLE, INTERACTIVE MAN-MACHINE COMMUNICATION: 1972 ANNUAL
REPORT (TECHNICAL REPORT NO. 66). NEW HAVEN, CONNECTICUT: YALE UNIVERSITY,
DEPARTMENT OF ADMINISTRATIVE SCIENCES, MARCH 1973, 30-64. (NTIS NO. AD 760C10)
DESCRIPTION:

TO DEMONSTRATE THAT, FOR USERS WITH VARYING PSYCHOLOGICAL CHARACTERISTICS, ALTERNATIVE MODES OF MAN-COMPUTER DIALOGUE SHOULD BE PROVIDED FOR A GIVEN TASK, AN EXPERIMENTAL DESIGN HAS BEEN FORMULATED. THE RESEARCH ON SPECIFIC HYPOTHESES INVOLVING CONCEPTUAL COMPLEXITY AND ENVIRONMENTAL COMPLEXITY DESCRIBED IN THIS REPORT IS CURRENTLY IN PROGRESS. TO FACILITATE THE DESIGN OF ALTERNATIVE MODES OF MAN-COMPUTER DIALOGUE, A TECHNIQUE OF PROTOCOL ANALYSIS FOR INFORMATION SYSTEM DESIGN IS BEING ADAPTED FROM THAT USED IN ARTIFICIAL INTELLIGENCE RESEARCH. A DESCRIPTION OF THIS NEW TECHNIQUE IS INCLUDED IN THIS REPORT. TWO PAPERS OUTLINING SOME OF THE OBJECTIVES AND METHODOLOGIES CURRENTLY IN USE THROUGHOUT THE COUNTRY FOR INVESTIGATION OF USER BEHAVIOR AND FOR INTERFACING SYSTEMS WITH ONE ANOTHER ARE ALSO INCLUDED. (A) 35P, 39R.

COMMENTS:

THIS PAPER REPORTS ON ONE ASPECT OF A RESEARCH PROJECT DIRECTED AT UNDERSTANDING DECISION-MAKING IN AN INTERACTIVE MAN-COMPUTER ENVIRONMENT. THE SPECIFIC FOCUS OF THIS PAPER IS ON DETERMINING WHAT TYPE OF MAN-COMPUTER DIALOGUE BEST FACILITATES SUC! INTERACTIONS. THE AUTHOR BEGINS WITH A BRIEF, BUT FAIRLY COMPREHENSIVE, REVIEW OF THE USE OF PROTOCOL ANALYSIS, "PROBLEM SPACES", AND RELATED CONCEPTS AS THEY ARE CURRENTLY BEING USED IN PSYCHOLOGICAL STUDIES OF PROBLEM SOLVING. HE THEN PROPOSES A METHOD FOR APPLYING THESE CONCEPTS TO THE DESIGN OF MAN-COMPUTER INTERACTION PROGRAMS. THE PRIMARY DIFFERENCE BETWEEN USING PROTOCOLS FOR THIS PURPOSE AND USING THEM TO STUDY PROBLEM SOLVING BEHAVIOR IS THAT IN THIS CASE THE INTENT IS TO DESIGN PROGRAMS FOR MAN-COMPUTER INTERACTION RATHER THAN TO PRODUCE SIMULATIONS OF HUMAN BEHAVIOR. THE USE OF PROTOCOL ANALYSIS TO DESIGN MAN-COMPUTER INTERACTION PROGRAMS APPEARS TO OFFER SEVERAL USEFUL ADVANTAGES. PERHAPS THE MOST IMPORTANT ADVANTAGE IS THAT THE POTENTIAL SYSTEM USERS ARE ACTIVELY INVOLVED THROUGHOUT THE DESIGN PROCESS. THIS ADVANTAGE IS SHARED BY OTHER METHODS, SUCH AS SIMULATION. PROTOCOL ANALYSIS CAN ALSO BE USEFUL IN DETECTING AND EXPLAINING INDIVIDUAL DIFFERENCES THAT COULD AFFECT THE SUCCESS OF THE INTERACTIVE SYSTEM. ALTHOUGH PROTOCOL ANALYSIS CAN PROVIDE VALUABLE INSIGHTS INTO HUMAN PERFORMANCE, AND WOULD BE USEFUL IN THE SYSTEM DESIGN PROCESS, MORE EXACT METHODOLOGIES SHOULD BE USEFUL IN THE SYSTEM DESIGN PROCESS, MORE EXACT METHODOLOGIES SHOULD BE USEFUL IN THE SYSTEM DESIGN PROCESS, MORE EXACT METHODOLOGIES SHOULD BE USEFUL IN THE SYSTEM DESIGN PROCESS, MORE EXACT METHODOLOGIES SHOULD BE USED TO TEST AND VALIDATE THE PROPOSED DESIGNS.

74 HUMAN FACTORS IN COMPUTER SYSTEMS (GENERAL)

CARLISLE, J.H. AN EXPERIMENTAL FRAMEWORK FOR HUMAN-COMPUTER INTERACTION
RESEARCH. PAPER PRESENTED AT THE 1974 MEETING OF THE HUMAN FACTORS SOCIETY,
HUNTSVILLE, ALABAMA, OCTOBER 1974 (REPRINTED BY THE INFORMATION SCIENCES
INSTITUTE AND ANNENBERG SCHOOL OF COMMUNICATION, UNIVERSITY OF SOUTHERN
CALIFORNIA, LOS ANGELES, CALIFORNIA).
DESCRIPTION:

THE EXPERIMENTAL FRAMEWORK PROPOSED IN THIS PAPER IS AN ATTEMPT TO PROVIDE A COMPREHENSIVE AND INTEGRATIVE FRAMEWORK FOR RESEARCH IN HUMAN COMPUTER INTERACTION (HCI) SYSTEM DESIGN AND UTILIZATION. THE FRAMEWORK SHOULD HELP IDENTIFY VARIABLES RELEVANT TO A GIVEN HCI SETTING AND PROMOTE THE DEFINITION AND GENERAL ACCEPTANCE OF APPROPRIATE MEASUREMENT TECHNIQUES. THE FRAMEWORK SHOULD HELP SYSTEMS DESIGNERS, PROGRAMMERS, USERS AND RESEARCHERS TO COMMUNICATE BETTER WITH ONE ANOTHER AND TO RECOGNIZE THE INTER-RELATIONSHIPS AMONG VARIOUS FACTORS IN AN HCI SETTING. THE FRAMEWORK CONTAINS TWO TYPES OF VARIABLES, "ENTITIES OF A HUMAN COMPUTER INTERACTION (HCI) SITUATION" AND "PERFORMANCE AND PROCESS CHARACTERISTICS." APPLICATIONS OF THE PROPOSED EXPERIMENTAL FRAMEWORK INCLUDE THE DESIGN, REPORTING, EVALUATION, AND COMPARISON OF RESEARCH ON THE USE OF SPECIFIC HUMAN COMPUTER INTERACTIVE SYSTEMS. (A) 12P, 22R.

COMMENTS:

THE APPLICATION OF PSYCHOLOGICAL KNOWLEDGE AND EXPERIMENTAL TECHNIQUES, THROUGH CONTROLLED EMPIRICAL RESEARCH, OFFERS GREAT POTENTIAL FOR UNDERSTANDING AND IMPROVING THE PROCESSES ASSOCIATED WITH MAN-COMPUTER INTERACTION. FOR THE MOST PART, HOWEVER, THIS POTENTIAL HAS NOT BEEN REALIZED. IN ORDER TO CONDUCT MEANINGFUL EMPIRICAL STUDIES, IT IS NECESSARY TO SATISFY THREE CRITERIA. FIRST, THE BEHAVIOR WE WISH TO STUDY MUST BE OBSERVABLE AND WE MUST HAVE SOME MEANINGFUL METHOD FOR MEASURING BEHAVIOR. SECOND, WE MUST UNDERSTAND THE SUBJECTS WE ARE STUDYING AND THE TASKS WE ASK THEM TO PERFORM SO THAT WE CAN UNDERSTAND HOW SUBJECT DIFFERENCES AND TASK DIFFERENCES AFFECT PERFORMANCE. THIRD, WE MUST BE ABLE TO EXPLAIN THE OBSERVED BEHAVIOR IN TERMS OF THE COGNITIVE PROCESSES THAT UNDERLY IT AND THE VARIABLES THAT AFFECT THESE PROCESSES AND NOT MERELY DESCRIBE THIS BEHAVIOR IN GROSS TERMS. ALTHOUGH MANY EMPIRICAL STUDIES OF VARIOUS TYPES OF MAN-COMPUTER INTERACTION HAVE BEEN REPORTED, MOST FAIL TO MEET THESE CRITERIA, AND THE THIRD CRITERION APPEARS TO BE THE MOST DIFFICULT TO SATISFY. THE PRINCIPAL IMPEDIMENT TO DEVELOPING A WELL-INTEGRATED AND USEFUL RESEARCH PROGRAM IS THE LACK OF A SOUND AND WELL-UNDERSTOOD THEORETICAL FRAMEWORK. SUCH A FRAMEWORK CAN BE USED TO SUGGEST AREAS WHERE RESEARCH IS NEEDED AND TO INTEGRATE THE RESULTS OF PREVIOUS STUDIES. THE FRAMEWORK PROPOSED IN THIS PAPER IS DESCRIBED AS AN "EXPERIMENTAL FRAMEWORK," ALTHOUGH THIS IS NOT A COMPREHENSIVE AND WELL-INTEGRATED THEORETICAL FRAMEWORK, IT DOES OUTLINE SEVERAL POTENTIALLY PELEVANT VARIABLES AND MAY PROVIDE A FIRST STEP TOWARD DEVELOPINNG SUCH A FRAMEWORK.

75 COMPLEXITY OF MAN-COMPUTER DIALOGUE
CARLISLE, J.H. MAN-COMPUTER INTERACTIVE PROBLEM SOLVING: RELATIONSHIPS
SETWEEN USER CHARACTERISTICS AND INTERFACE COMPLEXITY (DOCTORAL DISSERTATION
YALE UNIVERSITY, 1974). (UNIVERSITY MICROFILMS NO. 74-25725; SIMILAR PAPER:
NTIS NO. AD 786466)

DESCRIPTION:

THE PRIMARY OBJECTIVE OF THIS RESEARCH WAS TO DEMONSTRATE THAT THE INTERFACE LANGUAGE USED FOR MAN-COMPUTER INTERACTIVE PROBLEM SOLVING COULD BE VARIED IN COMPLEXITY WITH SIGNIFICANT IMPACT ON THE EFFECTIVENESS OF THE PROBLEM SOLVING EFFORT. IT WAS EXPECTED THAT THE OPTIMAL INTERFACE COMPLEXITY WOULD VARY DEPENDING UPON PSYCHOLOGICAL CHARACTERISTICS OF INDIVIDUAL PROBLEM SOLVERS.

COMPLEXITY OF THE USER LANGUAGE WAS MANIPULATED IN AN EXPERIMENTAL SETTING TO PROVIDE THREE LEVELS OF INTERFACE COMPLEXITY (IC). THIS WAS DONE BY ORGANIZING COMMANDS INTO A HIERARCHY WITH VARYING MAXIMUM NUMBER OF ALTERNATIVES PER NODE. THE THREE CONDITIONS OF LOW, MEDIUM, AND HIGH IC CONTAINED 3, 12, AND 21 COMMAND OPTIONS RESPECTIVELY, IN THE FIRST NODE. THE ENTERPRISE SIMULATION, A MAN-COMPUTER INTERACTION (MCI) BATTLE SIMULATION, WITH NUMEROUS BEHAVIORAL RESEARCH FEATURES, WAS DEVELOPED FOR USE IN THIS EXPERIMENT. THREE TYPES OF USER CHARACTERISTICS (UC) WERE MEASURED: COGNITIVE COMPLEXITY, VERBAL AND QUANTITATIVE INTELLIGENCE, AND PREVIOUS EXPERIENCE WITH COMPUTERS AND THE TASK. PROBLEM SOLVING EFFECTIVENESS WAS MEASURED IN TERMS OF PROCESS VARIABLES AND PERFORMANCE VARIABLES.

THE FOCUS IN THIS STUDY WAS ON COMPLEXITY OF THE USER INTERFACE BECAUSE THIS PARAMETER OF MCI SYSTEM DESIGN CAN BE VARIED BY DESIGNERS (OR USERS) TO IMPROVE PROBLEM SOLVING EFFECTIVENESS WITHOUT REQUIRING REDUCTION OF THE TOTAL CAPABILITIES OF THE SYSTEM. THE PROVISION OF MULTIPLE USER INTERFACES OR THE CAPABILITY TO ALTER THE INTERFACE INDEPENDENTLY OF UNDERLYING SYSTEM PROGRAMS CAN PROVE TO BE AN INEXPENSIVE BUT SIGNIFICANT MEANS OF INCREASING EFFECTIVE UTILIZATION OF COMPLEX MAN-COMPUTER INTERACTIVE SYSTEMS. (A) 190P, 42R.

COMMENTS:

THIS IS AN INTERESTING AND WELL-WRITTEN PAPER. ALTHOUGH IT MAY SEEM OBVIOUS THAT USER CHARACTERISTICS AND INTERFACE COMPLEXITY AFFECT PERFORMANCE, IT IS NOT ALTOGETHER CLEAR HOW TO DEFINE OR MEASURE THESE VARIABLES. THIS PAPER PROVIDES A START IN THIS DIRECTION. THE AUTHOR PROVIDES A USEFUL DISCUSSION OF THE METHODOLOGICAL AND THEORETICAL PROBLEMS INVOLVED IN SUCH RESEARCH AND SUGGESTS DIRECTIONS FOR FUTURE RESEARCH.

76 TELECONFERENCING, BIBLIOGRAPHY
CARLISLE, J.H. A SELECTED BIBLIOGRAPHY ON COMPUTER-BASED TELECONFERENCING
(REPORT NO. SAI-75-560-WA). ARLINGTON, VIRGINIA: SCIENCE APPLICATIONS, INC.,
AUGUST 1975.
DESCRIPTION:

THIS REPORT CONTAINS A BIBLIOGRAPHY ON COMPUTER-BASED TELECONFERENCING.
REFERENCES ARE ORGANIZED UNDER TWELVE TOPICS, DISTINGUISHING DESCRIPTIONS
OF OPERATIONAL SYSTEMS FROM PROPOSALS, DESIGNS FROM APPLICATIONS, AND
RELATED RESEARCH AREAS FROM THE FOCUS OF COMPUTER-BASED TELECONFERENCING.
SEVERAL INTRODUCTORY AND SURVEY ARTICLES ARE RECOMMENDED. SOURCES,
INCLUDING PERIODICALS, CONFERENCES, AND RESEARCH GROUPS INVOLVED IN
COMPUTER-BASED TELECONFERENCING ARE NOTED. A COMPLETE, ALPHABETIZED
LISTING OF REFERENCES IS ALSO INCLUDED. (A)
50P, 208R.

COMMENTS:

THIS REPORT WOULD BE A GOOD SOURCE PAPER FOR ANYONE INTERESTED IN COMPUTER-BASED TELECONFERENCING. OTHER AREAS FOR WHICH CITATIONS ARE LISTED INCLUDE MAN-COMPUTER INTERFACE DESIGN AND DISCUSSIONS OF HUMAN INFORMATION PROCESSING FROM BOTH PSYCHOLOGICAL AND COMMUNICATION THEORY VIEWPOINTS. THE BIBLIOGRAPHY INCLUDES REFERENCE CITATIONS ONLY.

77 DATA ENTRY ERRORS
CARLSON, G. PREDICTING CLERICAL ERROR IN AN EDP ENVIRONMENT. DATAMATION,
FEBRUARY 1963, 9, 34-36.
DESCRIPTION:

VERY LITTLE IS KNOWN ABOUT ERROR IN ANY PRECISE MANNER, EXCEPT THAT IT IS USUALLY PRESENT AND TROUBLESOME. THIS PAPER DESCRIBES AN ATTEMPT AT PREDICTING, OR SIMULATING, HUMAN ERROR. ERRORS MADE IN A NUMERIC DATA ENTRY TASK ARE ANALYZED AND A BINARY DECISION TREE IS DEVELOPED TO SIMULATE THESE ERRORS. THIS MODEL IS INDEPENDENT OF THE INDIVIDUAL OPERATOR AND TYPE OF WORK BEING DONE AND CORRECTLY PREDICTED 46% OF OBSERVED ERRORS.

COMMENTS:

THE AUTHOR MAKES SEVERAL STATEMENTS THAT HAVE A POTENTIALLY SIGNIFICANT IMPACT FOR ERROR ANALYSIS STUDIES. HE CLAIMS, FOR EXAMPLE, THAT STUDIES DIRECTED AT THE CORRELATION OR CLASSIFICATION OF ERRORS ARE "WORTHLESS" AND THAT THERE IS A SERIOUS NEED TO BE ABLE TO PREDICT ERRORS. THE MODEL PROPOSED HERE PREDICTS TYPES, BUT NOT FREQUENCIES, OF ERRORS. NO ATTEMPT IS MADE TO DESCRIBE THE MOTIVATION UNDERLYING THE DEVELOPMENT OF SUCH A MODEL OR TO DISCUSS THE IMPLICATIONS OF SUCH RESEARCH, AND THE MOTIVATION AND IMPLICATIONS ARE NOT APPARENT FROM THE BRIEF DISCUSSION CONTAINED IN THIS PAPER. ALTHOUGH A MODEL THAT COULD EXPLAIN DATA ENTRY ERRORS WOULD BE VERY USEFUL, SUCH A MODEL MAY PROVE VERY DIFFICULT TO DEVELOP. SUCH ATTEMPTS, HOWEVER, SHOULD FOCUS MORE ON THE ASPECTS OF HUMAN INFORMATION PROCESSING THAT LEAD TO ERRORS RATHER THAN ON MERELY DESCRIBING ERROR DATA.

COMPUTER-AIDED SCHEDULING

CARLSON, P., & HODGSON, T.J. AN INTERACTIVE HEURISTIC APPROACH FOR SCHEDULING
A MULTI-RESOURCE CONSTRAINED SYSTEM (REPORT NO. 77-10). GAINESVILLE, FLORIDA:
UNIVERSITY OF FLORIDA, DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING,
SEPTEMBER 1977. (NTIS NO. AD A045081)

THE SOLUTION TO A MULTI-RESOURCE, MULTI-PROJECT SCHEDULING PROBLEM IS APPROACHED IN A WAY THAT COMBINES HUMAN INTERACTION, HEURISTICS, AND OPTIMALITY SEEKING PROCEDURES. A TREE SEARCH ALGORITHM IS EMPLOYED TO PERFORM THE SEARCH. BY USE OF HEURISTICS, THE TREE CAN BE "PRUNED" SO AS TO LIMIT ITS BRANCHES, I.E., THE PROBLEM IS SIMPLIFIED AND COMPUTATIONAL TIMES FOR OPTIMALITY SEEKING PROCEDURES CAN BE DRASTICALLY REDUCED. BY MAN-COMPUTER INTERACTION, DATA AND CONSTRAINTS CAN BE CHANGED AND THE SEARCH THROUGH THE TREE CONTROLLED. THE MODEL DEVELOPED HAS BEEN IMPLEMENTED USING A MINICOMPUTER AND A VIDEO DISPLAY. TO HELP THE OPERATOR CONTROL THE SCHEDULING PROCEDURE DIFFERENT GRAPHICAL DISPLAYS ARE AVAILABLE. (A, ABBR.) 69P, 23R.

COMMENTS:

THE SYSTEM DESCRIBED HERE EMPLOYS A CPM (CRITICAL PATH METHOD) APPROACH TO SCHEDULING AND IS BASED ON A OPTIMALITY SEEKING ALGORITHM. SINCE SUCH AN ALGORITHM IS, IN MANY CASES, COMPUTATIONALLY INFEASIBLE, THE HUMAN OPERATOR IS ALLOWED TO INTERVENE AND DIRECT AND CONSTRAIN THE SEARCH PROCESS. THE COMBINATION OF THE COMPUTER'S ABILITY TO RAPIDLY EXECUTE ALGORITHMS AND THE HUMAN'S ABILITY TO RECOGNIZE CRITICAL PATTERNS AND PROVIDE OTHER HEURISTIC GUIDANCE IS, IN GENERAL, A GOOD BASIS FOR MAN-COMPUTER INTERACTION. IN THE SYSTEM DESCRIBED, THE DEGREE OF OPERATOR INTERVENTION CAN RANGE FROM NONE TO TOTAL CONTROL OF THE SCHEDULING PROCESS. ALTHOUGH THIS SYSTEM IS NOT TESTED EMPIRICALLY, IT DOES APPEAR TO BE EASY TO USE, BUT ITS ULTIMATE EFFECTIVENESS DEPENDS HEAVILY ON THE POWER OF THE OPTIMALITY SEEKING ALGORITHM USED. IN ADDITION, THE SYSTEM MAKES SOME ASSUMPTIONS ABOUT THE INTERCHANGABILITY OF RESOURCES THAT MAY MAKE IT INAPPLICABLE TO MANY SCHEDULING PROBLEMS OF INTEREST. THE SOURCE LISTING OF THIS SYSTEM, WRITTEN IN BASIC, IS PROVIDED, AND IT SHOULD BE FAIRLY SIMPLE FOR THOSE INTERESTED IN THIS SYSTEM TO IMPLEMENT IT. THIS PAPER WOULD BE OF INTEREST PRIMARILY ONLY TO ANYONE CONCERNED WITH INTERACTIVE SCHEDULING.

79 EMBEDDED TRAINING IN INFORMATION RETRIEVAL SYSTEMS
CARUSO, D.E. TUTORIAL PROGRAMS FOR OPERATION OF ON-LINE RETRIEVAL SYSTEMS.
JOURNAL OF CHEMICAL DOCUMENTATION, 1970, 10, 98-105.
DESCRIPTION:

THE LITERATURE ON INTERACTIVE COMPUTERIZED SEARCH SYSTEMS WHICH MAKE PROVISION FOR THE INEXPERIENCED USER IS SUMMARIZED. THREE SUCH SYSTEMS WITH VARIOUS USER-TRAINING FEATURES ARE DESCRIBED. NOVICE-USER INTERACTION WITH THESE SYSTEMS INDICATES THAT SELF-TEACHING SYSTEMS CAN PRODUCE A COMPETENT USER POPULATION WHICH DOES NOT REQUIRE AN INTERMEDIARY, HUMAN OR MECHANICAL, TO CREATE SEARCH STRATEGIES. (A)

COMMENTS:

AN INTERACTIVE DOCUMENT RETRIEVAL SYSTEMS CONSISTS OF SEVERAL ELEMENTS: THE USER, HIS QUERY, THE DATA FILE, SEARCH ROUTINES, AND FINAL OUTPUT. THIS PAPER FOCUSES PRIMARILY ON HELPING THE USER TO FORMULATE EFFECTIVE AND EFFICIENT QUERIES. IN BATCH RETRIEVAL SYSTEMS, IT IS COMMON TO HAVE AN "INFORMATION SPECIALIST" WHO IS FAMILIAR WITH THE SYSTEM AND ITS CAPABILITIES AND WHOSE JOB IS TO QUESTION THE USER ABOUT HIS NEEDS AND TO FORMULATE THE APPROPRIATE QUERY. ALTHOUGH AN INTERACTIVE RETRIEVAL SYSTEM HAS THE POTENTIAL FOR BRINGING THE USER INTO A MORE MEANINGFUL INTERACTION WITH THE SYSTEM AND ITS DATA BASE, IT PLACES ON THE USER THE BURDEN OF ADEQUATELY DEFINING HIS NEEDS. THIS PAPER DESCRIBES AN INTERACTIVE TUTORIAL PROGRAM THAT AIDS THE USER IN THIS REGARD WHICH, ON THE BASIS OF A BRIEFLY DESCRIBED EXPERIMENT, IS AT LEAST AS EFFECTIVE AS FORMAL CLASSROOM TRAINING. THIS PAPER PRESENTS SEVERAL USEFUL IDEAS CONCERNED WITH BOTH EMBEDDED TRAINING AND DOCUMENT RETRIEVAL AND SHOULD BE OF INTEREST TO ANYONE CONCERNED WITH EITHER OR BOTH OF THESE AREAS.

CEREBRAL LATERALIZATION AND DISPLAYS

CASEY, S.M. LATERAL ORIENTATION AND CEREBRAL ACTIVATION: CONSIDERATIONS FOR INFORMATION DISPLAY. IN PROCEEDINGS OF THE 21ST ANNUAL MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1977, 127-131.

DESCRIPTION:

THIS STUDY INVESTIGATED THE HYPOTHESIS THAT A LATERAL SHIFT IN THE DIRECTION OF AN OPERATOR'S ORIENTATION (LOOKING TO THE LEFT OR LOOKING TO THE RIGHT) WILL FACILITATE PROCESSING IN THE CEREBRAL HEMISPHERE WHICH IS CONTRALATERAL TO THE DIRECTION OF THE ORIENTATION SHIFT. IN VIEW OF THE SPECIALIZED FUNCTIONS OF EACH HEMISPHERE, IT WAS HYPOTHESIZED THAT DISPLAYS WITH "VERBAL" CONTENT WOULD BE BEST LOCATED 20 DEGREES TO THE RIGHT OF CENTER AND DISPLAYS WITH "SPATIAL" CONTENT WOULD BE BEST LOCATED 20 DEGREES TO THE LEFT OF CENTER. A LABORATORY STUDY WAS CONDUCTED TO TEST THIS THEORY. THE RESULTS SUPPORT THE IDEA THAT LATERAL EYE-GAZE ORIENTATION SHIFTS INFLUENCE HEMISPHERIC PROCESSING, IMPLYING THAT THIS PHENOMENON MAY BE A CONSIDERATION FOR SELECTIVELY LOCATING COMPLEX VISUAL DISPLAYS. (A) 5P, 16R.

COMMENTS:

THIS IS A VERY INTERESTING AND APPARENTLY WELL DONE EXPERIMENT THAT COULD HAVE SIGNIFICANT IMPLICATIONS FOR THE DESIGN OF VISUAL DISPLAYS. THE AUTHOR IS CORRECT IN NOTING THAT THE MOST DIFFICULT PROBLEM MAY BE IN DETERMINING THE HEMISPHERIC ADVANTAGE, IF ANY, ASSOCIATED WITH A GIVEN STIMULUS. ALTHOUGH THIS QUESTION MAY BE RESOLVABLE EMPIRICALLY, THIS IS A FAIRLY NEW AREA OF RESEARCH AND IT IS QUITE LIKELY THAT ALL RELEVANT VARIABLES HAVE NOT YET BEEN IDENTIFIED. THIS PAPER PROVIDES A CONCISE, READABLE DISCUSSION OF CEREBRAL LATERALIZATION AND INTRODUCES A POTENTIALLY PRODUCTIVE LINE OF RESEARCH.

CHANGING USER NEEDS IN INFORMATION RETRIEVAL SYSTEMS
CAVANAGH, J.M.A. SOME CONSIDERATIONS RELATING TO USER-SYSTEM INTERACTION IN
INFORMATION RETRIEVAL SYSTEMS. IN A.B. TONIK (ED.), INFORMATION RETRIEVAL:
THE USER'S VIEWPOINT; AN AID TO DESIGN. FOURTH ANNUAL NATIONAL COLLOQUIUM ON
INFORMATION RETRIEVAL. PHILADELPHIA, PENNSYLVANIA: INTERNATIONAL INFORMATION,
INC., 1967, 119-125.
DESCRIPTION:

THE PURPOSE OF AN INFORMATION SYSTEM IS TO AID THE USER IN ACHIEVING THE GOALS SET BY HIS SUPERIORS. SYSTEMS ARE DESIGNED TO SERVE THIS END BY ACQUIRING, ORGANIZING, AND DISSEMINATING INFORMATION OF THE KIND REQUIRED BY THE USERS. HOWEVER, THE EVDLUTION OF KNOWLEDGE IS A DYNAMIC PROCESS AND USER NEEDS IN AN INFORMATION SYSTEM ENVIRONMENT ARE SUBJECT TO CONTINUOUS CHANGE. UNFORTUNATELY, NO DESIGNER CAN CONTEMPLATE AN INFORMATION SYSTEM SO FLEXIBLE AS TO BE CAPABLE OF ACCOMMODATING ALL OF THE REQUIPEMENTS OF ALL POTENTIAL USERS.

IDEALS HAVE TO BE SACRIFICED TO ECONOMY AND PRACTICALITY AND DESIGNS HAVE TO BE FROZEN AT SOME POINT IF THEY ARE EVER TO BECOME OPERATIONAL. THE RESULT OF COMPROMISING IN THE DESIGN OF OUR INFORMATION SYSTEMS IS THAT WE HAVE ESSENTIALLY STATIC SYSTEMS OPERATING IN DYNAMIC ENVIRONMENTS. THE MESSAGE FOR USERS IS THAT THEY MUST ADAPT TO THE SYSTEMS THEY ENCOUNTER. (A, ABBR.) 7P, 7R.

COMMENTS:

THIS IS A VERY HIGH-LEVEL DISCUSSION OF SOME OF THE RELEVANT PROPERTIES OF USERS OF INFORMATION SYSTEMS. AT THE TIME THIS PAPER WAS WRITTEN, THERE WERE VERY FEW SYSTEMATIC STUDIES OF THE ROLE OF THE USER IN INFORMATION SYSTEMS AND THE AUTHOR'S INTENT IS TO DEFINE AREAS WHERE RESEARCH IS NEEDED. THIS PAPER WOULD BE RELEVANT PRIMARILY TO THOSE INTERESTED IN TRACING HISTORICAL TRENDS IN INFORMATION RETRIEVAL SYSTEM DEVELOPMENT.

AUTOMATED AIDS FOR POWER PLANT OPERATION
CHACHKO, A. MONITOR AND CONTROL INSTRUMENTATION PANELS AND DISPLAYS
(TRANSLATION OF NAUKA I ZHIZN (NSSR), 1975, N. 8, PP. 2-13. ARLINGTON,
VIRGINIA: JOINT PUBLICATIONS RESEARCH SERVICE, DECEMBER 1975. (NTIS NO.
JPRS 66406)

DESCRIPTION:
THIS PAPER DESCRIBES FOUR GENERATIONS OF MONITOR AND CONTROL PANELS, RANGING FROM A SITUATION IN WHICH EACH INSTRUMENT HAS ITS OWN INDIVIDUAL FUNCTION TO ONE IN WHICH TRADITIONAL INSTRUMENTS ARE TOTALLY ABSENT. ALSO CONSIDERED IS A SYSTEM TO FACILITATE MAN-COMPUTER PROBLEM SOLVING.

COMMENTS:

THIS PAPER DESCRIBES THE ARGD (ANALYSIS AND RECOMMENDATION DURING GRAPHIC DISPLAY) SYSTEM THAT IS INTENDED TO AID A POWER PLANT OPERATOR IN SITUATIONS WHERE FAILURES HAVE OCCURRED OR ARE EXPECTED. A KEY ASSUMPTION APPEARS TO BE THAT BOTH THE COMPUTERIZED SYSTEM AND HUMAN OPERATOR HAVE A COMMON SEMANTIC UNDERSTANDING OF POWER PLANT OPERATIONS AND A COMMON SET OF PROBLEM SOLVING PROCESSES TO SOLVE OR AVOID PROBLEMS. THE COMPUTER WOULD THEN BE CAPABLE OF DOING THE ACTUAL PROBLEM SOLVING, SUGGESTING ALTERNATIVES TO THE OPERATOR, ETC. THIS SYSTEM APPEARS TO BE SIMILAR TO THE SOPHIE SYSTEM DESCRIBED BY J.S. BROWN, R.R. BURTON, A.G. BELL, AND R.J. BOBROW (1974).

USER ACCEPTANCE

CHALMERS, J.R. COMPUTERS AND DESIGNERS. DOE CONSTRUCTION 14.

DESCRIPTION:

TWO YEARS AFTER THE INSTALLATION OF TERMINALS FOR COMPUTER-AIDED DESIGN, A SURVEY WAS CONDUCTED TO DETERMINE WHY USAGE WAS NOT GROWING AT THE EXPECTED LEVEL. THE MAJOR REASONS FOR LOW USAGE WERE DETERMINED TO BE THE LACK OF SUITABLE PROGRAMS FOR CERTAIN PURPOSES, UNCLEAR PROGRAM DOCUMENTATION, AND SLOW INPUT-DUTPUT RATES. A PILOT SYSTEM TO ALLEVIATE THESE PROBLEMS IS DESCRIBED AND THE IMPACT ON USER ACCEPTANCE AND PRODUCTIVITY IS DISCUSSED. THE PRINCIPAL CONCLUSIONS ARE THAT A USER WILL USE A SYSTEM IN SPITE OF DIFFICULTIES IF HE PERCEIVES A CLEAR BENEFIT AND THAT INTENSIVE INDIVIDUAL SUPPORT IS NECESSARY TO INDUCE MORE PEOPLE TO USE THE SYSTEM.

4P, DR.

COMMENTS:

THE ORIGINAL SYSTEM DESCRIBED HERE HAS OBVIOUS DEFECTS BOTH IN HUMAN FACTORS CONSIDERATIONS AND IN THE FUNCTIONS THAT THE SYSTEM PERFORMED. IN THE IMPROVED VERSION, THE TIME AND COST ASSOCIATED WITH ENGINEERING DESIGN WERE CONSIDERABLY REDUCED BUT USER ACCEPTANCE WAS STILL VERY LOW. ALTHOUGH A USER GROUP WAS FORMED TO AID IN THE IDENTIFICATION OF USER NEEDS, THIS IMPLIES THAT EITHER THE IDENTIFICTION OF NEEDS OR THE IMPLEMENTATION OF THE CORRESPONDING FUNCTIONS WAS NOT TOTALLY SUCCESSFUL.

RULES OF THUMB FOR INTERACTIVE SYSTEM DESIGN CHAMBERLAIN, R.G. CONVENTIONS FOR INTERACTIVE COMPUTER PROGRAMS. INTERFACES, NOVEMBER 1975 (PT. 1), 6(1), 77-82. DESCRIPTION:

THIS ARTICLE PRESENTS 28 RULES OF THUMB FOR INTERACTIVE MAN-COMPUTER DIALOGUE AND BRIEFLY DISCUSSES EACH.

6P, 2R. COMMENTS:

THE RULES OF THUMB PRESENTED HERE ARE, FOR THE MOST PART, QUITE GOOD. THEY ARE PRESENTED BRIEFLY AND READABLY. THE DANGER OF SUCH A PRESENTATION IS THAT IT FAILS TO SUGGEST WHEN THE RULES SHOULD NOT BE OBSERVED. AS LONG AS THEY ARE APPLIED THOUGHTFULLY AND KNOWLEDGEABLY, RATHER THAN RIGIDLY, SUCH RULES CAN BE VERY HELPFUL. THESE, OR A MORE COMPLETE SET LIKE THEM (E.G., S.E. ENGEL & R.E. GRANDA, 1975) SHOULD BE REQUIRED READING FOR INTERACTIVE SYSTEM DESIGNERS AND PROGRAMMERS.

85 MAN-COMPUTER TASK ALLOCATION
CHAPANIS, A. ON THE ALLOCATION OF FUNCTIONS BETWEEN MEN AND MACHINES.
OCCUPATIONAL PSYCHOLOGY, 1965, 39, 1-11. (NTIS NO. AD 626311)
DESCRIPTION:

NUMEROUS WRITERS AGREE THAT ONE OF THE FIRST AND MOST IMPORTANT PROBLEMS IN MAN-MACHINE SYSTEM DESIGN HAS TO DO WITH THE ALLOCATION OF FUNCTIONS BETWEEN MEN AND MACHINES. THE PROBLEM CAN BE VIEWED FROM SEVERAL POINTS OF VIEW AND THERE IS A CONSIDERABLE AMOUNT OF UNCERTAINTY ABOUT HOW ALLOCATION DECISIONS CAN BEST BE APPROACHED. IN THIS PAPER, I SHALL TRY TO DO FOUR THINGS: (1) DESCRIBE THE NATURE OF THE ALLOCATION PROBLEM, (2) SAY SOMETHING ABOUT THE APPROACHES THAT HAVE BEEN TAKEN TO THIS PROBLEM IN THE PAST, (3) GIVE YOU A FEW OF MY VIEWS ON THE CONTEMPORARY STATUS OF THE PROBLEM, AND (4) SUGGEST A STRATEGY FOR DEALING WITH IT. (A, ABBR.) 11P, 17R.

COMMENTS:

THIS PAPER PRESENTS A FAIRLY GENERAL AND EASY TO READ DISCUSSION OF MAN-MACHINE TASK ALLOCATION. ALTHOUGH THIS PAPER IS SOMEWHAT DATED, MANY OF THE CONCEPTS DISCUSSED ARE STILL WORTH CONSIDERING. FOR EXAMPLE, THE NEED TO CONTINUALLY RE-EVALUATE ALLOCATION DECISIONS AS THE RELEVANT TECHNOLOGY CHANGES IS A CONTINUOUS PROBLEM AREA AND THE EFFECTS OF SOCIAL, ECONOMIC, AND POLITICAL VALUES ON ALLOCATION DECISIONS IS AN IMPORTANT, THOUGH LARGELY IGNORED, CONSIDERATION. PERHAPS THE MOST IMPORTANT POINT MADE HERE IS THAT TASK ALLOCATION DECISIONS ARE NOT ABSOLUTE, BUT MUST INVOLVE CONSIDERATIONS OF COST, COMMUNICATION LOAD, ETC., AS WELL AS CONSIDERATIONS OF THE CAPABILITIES OF THE COMPUTER AND THE OPERATOR. THIS PAPER PROVIDES A GOOD INTRODUCTORY DISCUSSION OF MAN-MACHINE TASK ALLOCATION.

86 INTERPERSONAL DIALOGUE
CHAPANIS, A. PRELUDE TO 2001: EXPLORATIONS IN HUMAN COMMUNICATION. AMERICAN
PSYCHOLOGIST, 1971, 26, 949-961.
DESCRIPTION:

BEFORE WE CAN DEVELOP EFFECTIVE TECHNIQUES FOR MAN-COMPUTER COMMUNICATION, WE MUST UNDERSTAND HOW PEOPLE COMMUNICATE. THE FIELD OF HUMAN COMMUNICATION, HOWEVER, HAS RECEIVED VERY LITTLE ATTENTION. THE THESIS OF THIS PAPER IS THAT COMMUNICATION IS AN IMPORTANT FIELD FOR PSYCHOLOGICAL STUDY. VARIOUS ASPECTS OF HUMAN COMMUNICATION ARE REVIEWED AND THE RELATIONS BETWEEN HUMAN COMMUNICATION AND MAN-COMPUTER COMMUNICATION ARE DISCUSSED.

COMMENTS:

THIS PAPEP PROVIDES A GENERAL DESCRIPTION OF THE STUDY OF ENGINEERING PSYCHOLOGY AND EXPLAINS HOW THIS FIELD RELATES BOTH TO ENGINEERING AND PSYCHOLOGY IN GENERAL. IT CONTAINS A WELL-WRITTEN AND EASY-TO-READ INTRODUCTION TO THE STUDIES OF HUMAN AND OF MAN-COMPUTER COMMUNICATION. THIS PAPER MAY BE A GOOD STARTING POINT FOR THOSE INTERESTED IN INTERPERSONAL DIALOGUE.

87 INTERPERSONAL DIALOGUE

CHAPANIS, A. THE COMMUNICATION OF FACTUAL INFORMATION THROUGH VARIOUS CHANNELS. INFORMATION STORAGE AND RETRIEVAL, 1973, 9, 215-231.
DESCRIPTION:

THE RESEARCH REPORTED HERE IS AIMED AT DISCOVERING PRINCIPLES OF HUMAN COMMUNICATION THAT MAY BE USEFUL IN THE DESIGN OF CONVERSATIONAL COMPUTERS OF THE FUTURE. TWO-MAN TEAMS WERE ASKED TO SOLVE CREDIBLE, REAL-WORLD PROBLEMS OF THE KIND FOR WHICH COMPUTERS HAVE BEEN, OR COULD BE, OF ASSISTANCE. THE TEAMS COMMUNICATED IN DIFFERENT MODES SIMULATING VARIOUS INPUT-OUTPUT CHANNELS BETWEEN THE COMPUTER AND ITS HUMAN USER. THESE MODES WERE: TYPEWRITING, HANDWRITING, VOICE, AND NATURAL UNRESTRICTED COMMUNICATION.

THE RESULTS OF TWO EXPERIMENTS SHOW THAT SUBJECTS CAN SOLVE PROBLEMS MUCH FASTER WHEN THEY COMMUNICATE IN EITHER OF THE TWO ORAL MODES (VOICE AND NATURAL COMMUNICATION) RATHER THAN IN EITHER OF THE TWO HARD-COPY MODES (TYPEWRITING AND HANDWRITING). ONE COMPARISON SHOWS THAT TYPING SKILL PER SE APPARENTLY HAS ONLY A SMALL INFLUENCE ON COMMUNICATION TIME. ALTHOUGH SOLUTIONS WERE REACHED MUCH MORE QUICKLY IN THE TWO ORAL MODES, THE NUMBER OF MESSAGES AND THE NUMBER OF WORDS EXCHANGED IN THESE MODES IS VERY MUCH GREATER THAN THE CORRESPONDING NUMBERS IN THE HARD-COPY MODES, THUS IMPLYING GREATLY DIFFERENT RATES OF INFORMATION TRANSMISSION.

NATURAL HUMAN COMMUNICATION IS CHARACTERIZED BY A GREAT MANY SMALL ERRORS THAT WOULD RESULT IN A COMPLETE FAILURE OF COMMUNICATION BETWEEN MAN AND COMPUTER. IF THEY ARE TO BE TRULY CONVERSATIONAL, COMPUTERS OF THE FUTURE WILL HAVE TO BE MADE MUCH MORE FORGIVING OF THE MANY SMALL ERRORS THAT WE SO READILY ACCEPT AND OVERLOOK IN OUR ORDINARY COMMUNICATIONS. THE FREEDOM TO INTERRUPT MESSAGES IS AN EXPENSIVE OPTION TO PROVIDE IN COMPUTER SYSTEMS. ONE SERIES OF COMPARISONS SHOWS THAT THE FREEDOM TO INTERRUPT HAS ONLY A NEGLIGIBLE EFFECT ON THE EFFICIENCY OF HUMAN COMMUNICATION.

THE PAPER ENDS WITH A STATEMENT OF SOME PROBLEMS STILL TO BE SOLVED IF WE ARE EVER TO HAVE TRULY INTERACTIVE CONVERSATIONAL COMPUTERS. (A) 17P, 4R.

COMMENTS:

THE EXPERIMENTS REPORTED IN THIS PAPER APPEAR TO HAVE BEEN CAREFULLY CONTROLLED AND WELL SUITED FOR EXAMINING PRINCIPLES OF HUMAN COMMUNICATION. UNFORTUNATELY, THE ANALYSES OF THE RESULTS ARE NOT REPORTED AND, THEREFORE, THE CONCLUSIONS REPORTED IN THIS PAPER ARE NOT CLEARLY DEMONSTRATED HERE. IN ADDITION, THE METHOD OF PRESENTING RESULTS MAY OBSCURE RELEVANT INFORMATION. THE TASKS USED IN THESE EXPERIMENTS DIFFERED IN THAT SOME REQUIRED THE COMMUNICATION OF SPECIFIC PROCEDURES. A. COLLINS, E.H. WARNOCK, AND J.J. PASSAFIUME (1974) NOTED THAT THE STRATEGIES USED TO TEACH PROCEDURAL KNOWLEDGE DIFFER FROM THOSE USED TO TEACH DECLARATIVE KNOWLEDGE. IN VIEW OF THIS, IT SEEMS REASONABLE TO EXPECT THAT THE STRATEGIES USED IN COMMUNICATING INFORMATION MAY DIFFER AS A FUNCTION OF THE SPECIFIC TASKS INVOLVED. SINCE THE PERFORMANCE DATA REPORTED IN THIS PAPER WERE AVERAGED ACROSS TASKS, THIS INFORMATION IS LOST. NEVERTHELESS, THIS PAPER PRESENTS SOME INTERESTING SUGGESTIONS FOR FUTURE RESEARCH AND SHOULD BE OF INTEREST TO THOSE CONCERNED WITH INTERPERSONAL DIALOGUE AND THE DESIGN OF MAN-COMPUTER DIALOGUES.

88 INTERPERSONAL DIALOGUE

CHAPAN'S, A. INTERACTIVE HUMAN COMMUNICATION. SCIENTIFIC AMERICAN, MARCH 1975, 232(3), 36-42.
DESCRIPTION:

A SERIES OF EXPERIMENTS IS DESCRIBED IN WHICH TWO MEMBERS OF A PROBLEMSOLVING TEAM ARE EACH GIVEN PARTIAL PROBLEM INFORMATION. ONE OF THEM, THE
"SEEKER", IS ASSIGNED A PARTICULAR TASK TO PERFORM, FOR WHICH HE REQUIRES
INFORMATION POSSESSED BY THE OTHER, THE "SOURCE". THE ROLES OF THESE
SUBJECTS ARE INTENDED TO CORRESPOND LOOSELY TO THOSE OF COMPUTER SYSTEM USER
AND COMPUTER SYSTEM, RESPECTIVELY. THE SUBJECTS ARE ALLOWED TO COMMUNICATE
THROUGH VARIOUS MEDIA (VOICE, VIDEO, HANDWRITING, TYPEWRITING, AND VARIOUS
COMBINATIONS), AND THE EFFECTS, BOTH ON PROBLEM-SOLVING EFFECTIVENESS AND
ON THE NATURE OF THE CONVERSATION, ARE OBSERVED. CONVERSATIONS, WHILE
EFFECTIVE, WERE FOUND TO BE EXTREMELY UNGRAMMATICAL BY FORMAL ENGLISH
GRAMMAR STANDARDS. THE PRESENCE OR ABSENCE OF VOICE COMMUNICATION AS ONE OF
THE ALLOWED MEDIA WAS THE MOST IMPORTANT EXPERIMENTAL VARIABLE. EXPERIMENTAL
CONDITIONS INVOLVING VOICE COMMUNICATION HAD MORE AND SHORTER MESSAGES,
MORE TOTAL WORDS EXCHANGED, GREATER MESSAGE REDUNDANCY, GREATER COMMUNICATION
RATES AND FASTER PROBLEM SOLUTION THAN OTHER CONDITIONS.
7P. 3R.

COMMENTS:

THIS IS A VERY READABLE, SOMEWHAT POPULARIZED DESCRIPTION OF THE RESEARCH PROGRAM BEING CONDUCTED BY CHAPANIS AND HIS COLLEAGUES AT JOHNS HOPKINS UNIVERSITY. THE RESEARCH IS INTENDED TO INVESTIGATE INTERPERSONAL COMMUNICATION UNDER CIRCUMSTANCES SIMILAR TO THOSE INVOLVED IN MAN-COMPUTER DIALOGUE. THE AUTHOR'S THESIS IS THAT THE RESULTS OF SUCH RESEARCH WILL HELP US IMPROVE MAN-COMPUTER SYSTEM PERFORMANCE BY ALLOWING US TO DUPLICATE SOME ASPECTS OF THE "NATURAL" INTERPERSONAL DIALOGUE OF THE USER. THE FINDING THAT "VOICE" DIALOGUE IS HIGHLY BENEFICIAL IN THE EXPERIMENTAL TASKS STUDIED HAS IMPORTANT IMPLICATIONS FOR THE FUTURE OF AUTOMATED SPEECH, IF THE FINDING IS ALSO APPLICABLE TO MAN-COMPUTER DIALOGUE. THE LATTER POINT IS DEBATED BY SOME. THE FINDING WHICH HAS EVEN BROADER IMPLICATIONS IS THE "UNGRAMMATICAL" NATURE OF "NATURAL" DIALOGUE. THERE ARE MANY WHO ADVOCATE FORMAL ENGLISH (OR OTHER NATURAL LANGUAGE) AS THE ULTIMATE MAN-COMPUTER DIALOGUE TECHNIQUE. THE RESEARCH RESULTS REPORTED HERE SUGGEST THAT A MUCH LESS FORMAL LANGUAGE IS USED IN ACTUAL SPOKEN DIALOGUE. THIS LESS FORMAL GRAMMAR IS MUCH MORE DIFFICULT TO AUTOMATE, SINCE IT DEPENDS MUCH MORE HEAVILY ON RELEVANT KNOWLEDGE AND CONTEXTUAL CUES. A MORE UP-TO-DATE BUT LESS ACCESSIBLE DESCRIPTION OF THIS RESEARCH IS A. CHAPANIS (1976). EITHER IS RECOMMENDED READING FOR THOSE MORKING IN THE MAN-COMPUTER DIALOGUE AREA.

89 INTERPERSONAL DIALOGUE

CHAPANIS, A. INTERACTIVE HUMAN COMMUNICATION: SOME LESSONS LEARNED FROM LABORATORY EXPERIMENTS. PAPER PRESENTED AT NATO ADVANCED STUDY INSTITUTE ON MAN-COMPUTER INTERACTION, MATI, GREECE, SEPTEMBER 1976.
DESCRIPTION:

THIS PAPER SUMMARIZES THE RESULTS OF 11 SEPARATE EXPERIMENTS THAT HAVE BEEN REPORTED BY CHAPANIS AND HIS COLLEAGUES. THE PURPOSE OF THIS PAPER IS TO PRESENT AN INTEGRATED DESCRIPTION OF THIS RESEARCH PROGRAM.

THE GOALS OF THIS RESEARCH PROGRAM ARE TO DISCOVER (A) HOW PEOPLE NATURALLY COMMUNICATE WITH EACH OTHER WHEN THEY ARE REQUIRED TO SOLVE PROBLEMS OF VARIOUS KINDS, (B) HOW INTERACTIVE HUMAN COMMUNICATION IS AFFECTED BY THE MACHINE DEVICES AND SYSTEMS THROUGH WHICH PEOPLE CONVERSE, AND (C) WHAT SIGNIFICANT SYSTEM AND HUMAN VARIABLES EFFECT INTERACTIVE COMMUNICATION. (A)

63P, 19R. COMMENTS:

THIS IS A PRELIMINARY VERSION OF A PAPER PUBLISHED AS "HUMAN FACTORS IN TELECONFERENCING SYSTEMS" (TECHNICAL REPORT NO. NSF/RA-760575). BALTIMORE, MARYLAND: JOHNS HOPKINS UNIVERSITY, NOVEMBER 1976. (NTIS NO. PB 268453)

O INTERPERSONAL DIALOGUE
CHAPANIS, A. HUMAN FACTORS IN TELECONFERENCING SYSTEMS (TECHNICAL REPORT NO. NSF/RA-760575). BALTIMORE, MARYLAND: JOHNS HOPKINS UNIVERSITY, NOVEMBER 1976.
(NTIS NO. PB 268453)
DESCRIPTION:

THIS REPORT ON HUMAN FACTORS IN TELECOMMUNICATIONS AND TELECONFERENCING SYSTEMS EXTRACTS SOME OF THE MOST INTERESTING FINDINGS OF THE SEVERAL STUDIES REFERRED TO HEREIN AND INTEGRATES THOSE FINDINGS INTO A SERIES OF BROADER GENERALIZATIONS. RESEARCH GOALS ARE TO DISCOVER: (1) HOW PEOPLE MATURALLY COMMUNICATE WITH EACH OTHER WHEN THEY ARE REQUIRED TO SOLVE PROBLEMS OF VARIOUS KINDS, (2) HOW INTERACTIVE HUMAN COMMUNICATION IS AFFECTED BY THE MACHINE DEVICES AND SYSTEMS THROUGH WHICH PEOPLE CONVERSE, AND (3) WHAT SIGNIFICANT SYSTEM AND HUMAN VARIABLES AFFECT INTERACTIVE COMMUNICATION. ALL RESEARCH CONDUCTED IN THIS PROGRAM HAS BEEN DONE BY HAVING PEOPLE COMMUNICATE WITH ONE ANOTHER IN VARIOUS WAYS. NINE SEPARATE EXPERIMENTS ARE CONDUCTED, ANALYZED, AND REPORTED. A COMPLETE LIST OF THE SUBSEQUENT THIRTEEN PUBLICATIONS IS INCLUDED IN THIS REPORT. (A) 50P, 14R.

COMMENTS:

THIS IS A CONCISE DESCRIPTION OF THE RESEARCH PROGRAM CONDUCTED BY CHAPANIS AND HIS COLLEAGUES AT JOHNS HOPKINS UNIVERSITY ON INTERPERSONAL COMMUNICATION. RATHER THAN DESCRIBE THE INDIVIDUAL STUDIES (THAT ARE INCLUDED ELSEWHERE IN THIS BIBLIOGRAPHY) IN DETAIL, THE AUTHOR INTEGRATES THE PRINCIPAL FINDINGS AND PRESENTS A SERIES OF BROAD GENERALIZATIONS THAT ARE DERIVED FROM THIS RESEARCH PROGRAM. IT IS INTENDED THAT THE RESULTS OF THIS RESEARCH ON INTERPERSONAL DIALOGUS WILL BE APPLICABLE IN DEVELOPING MAN-COMPUTER DIALOGUES. THIS IS AN EXCELLENT OVERVIEW OF THIS RESEARCH AND THOSE INTERESTED IN THIS RESEARCH SHOULD BEGIN WITH THIS PAPER AND THEN PURSUE TOPICS OF INTEREST IN THE MORE DETAILED DESCRIPTIONS CITED IN THE AUTHOR'S BIBLIOGRAPHY.

91 INTERPERSONAL DIALOGUE

CHAPANIS, A., OCHSMAN, R.B., PARRISH, R.N., & WEEKS, G.D. STUDIES IN INTERACTIVE COMMUNICATION: I. THE EFFECTS OF FOUR COMMUNICATION MODES ON THE BEHAVIOR OF TEAMS DURING COOPERATIVE PROBLEM-SOLVING. HUMAN FACTORS, 1972, 14, 487-509.

DESCRIPTION:

TWO-MAN TEAMS SOLVED CREDIBLE, "REAL-WORLD" PROBLEMS FOR WHICH COMPUTER ASSISTANCE HAS BEEN OR COULD BE USEFUL. CONVERSATIONS WERE CARRIED ON IN ONE OF FOUR MODES OF COMMUNICATION: (1) TYPEWRITING, (2) HANDWRITING, (3) VOICE, AND (4) NATURAL, UNRESTRICTED COMMUNICATION. TWO GROUPS OF SUBJECTS (EXPERIENCED AND INEXPERIENCED TYPISTS) WERE TESTED IN THE TYPEWRITING MODE. PERFORMANCE WAS ASSESSED ON THREE CLASSES OF DEPENDENT MEASURES: TIME TO SOLUTION, BEHAVIORAL MEASURES OF ACTIVITY, AND LINGUISTIC MEASURES. SIGNIFICANT AND MEANINGFUL DIFFERENCES AMONG THE COMMUNICATION MODES WERE FOUND IN EACH OF THE THREE CLASSES OF DEPENDENT VARIABLE. THIS PAPER IS CONCERNED MAINLY WITH THE RESULTS OF THE ACTIVITY ANALYSES. BEHAVIOR WAS RECORDED IN 15 DIFFERENT CATEGORIES. THE ANALYSES OF VARIANCE YIELDED 34 STATISTICALLY SIGNIFICANT TERMS OF WHICH 27 WERE JUDGED TO BE PRACTICALLY SIGNIFICANT AS WELL. WHEN THE DATA WERE TRANSFORMED TO ELIMINATE HETEROGENEITY, THE ANALYSES OF VARIANCE YIELDED 35 STATISTICALLY SIGNIFICANT TERMS OF WHICH 26 WERE JUDGED TO BE PRACTICALLY SIGNIFICANT. (A) 23P, 44R.

COMMENTS:

THIS PAPER PRIMARILY REPORTS ACTIVITY ANALYSIS DATA INDICATING THE PROPORTION OF TOTAL TIME SPENT BY EACH SUBJECT IN THE CATEGORIES "SENDING ONLY", "SENDING PAUSE", "RECEIVING JNLY", "SEARCHING ONLY", "HANDLING PARTS", "MAKING NOTES", "WAITING", SIX COMBINATIONS OF THE ABOVE, AND "OTHER". DIFFERENT COMMUNICATION MODES EXHIBITED VERY DIFFERENT ACTIVITY ANALYSIS PATTERNS, AS WELL AS DIFFERING IN TOTAL TIME TO SOLUTION AND IN OTHER RESPECTS. IT IS DIFFICULT TO KNOW HOW READILY SUCH ACTIVITY DATA ARE APPLICABLE TO USER BEHAVIOR IN CORRESPONDING MAN-COMPUTER DIALOGLE SETTINGS. THE MAJOR FINDINGS (E.G., TYPEWRITING AND HANDWRITING INVOLVE RELATIVELY HIGH "SENDING" TIMES) ARE CLEARLY PROPERTIES OF THE COMMUNICATION MEDIA, AND UNDOUBTEDLY GENERALIZE TO CORRESPONDING MAN-COMPUTER DIALOGUE. IN MANY SETTINGS, THOUGH, COMPUTER THIS BOTTLENECK. THE SUBTLER EFFECTS OBSERVED IN THIS STUDY MAY OR MAY NOT GENERALIZE TO MAN-COMPUTER COMMUNICATION. THE PAPER REPORTS A LARGE NUMBER OF DETAILED OBSERVATIONS CONCERNING SUBJECT BEHAVIOR IN THIS PROBLEM-SOLVING SETTING, WHICH WAS INTENDED TO DUPLICATE SOME ASPECTS OF THE CORRESPONDING COMPUTER-AIDED PROBLEM-SOLVING ENVIRONMENT. THE PAPER WILL INTEREST THOSE WHO WANT A FAIRLY DETAILED PICTURE OF USER BEHAVIOR IN INTERACTIVE DIALOGUE, OR WHO ARE INTERESTED IN A COMPARISOM OF VARIOUS DIALOGUE MEDIA.

92 INTERPERSONAL DIALOGUE

CHAPANIS, A., & OVERBEY, C.M. STUDIES IN INTERACTIVE COMMUNICATION: III. EFFECTS OF SIMILAR AND DISSIMILAR COMMUNICATION CHANNELS AND TWO INTERCHANGE OPTIONS ON TEAM PROBLEM SOLVING. PERCEPTUAL AND MOTOR SKILLS, 1974, 38, 343-374. (MONOGRAPH)

DESCRIPTION:

SIXTEEN TEAMS OF TWO COLLEGE STUDENTS EACH SOLVED FOUR CREDIBLE "REAL WORLD" PROGLEMS FOR WHICH COMPUTER SYSTEMS HAVE BEEN OR COULD BE USEFUL. EACH OF THE FOUR PROBLEMS WAS SOLVED ON FOUR SUCCESSIVE DAYS. A TEAM MEMBER SENT MESSAGES EITHER BY VOICE OR BY TYPEWRITER, AND EVERY TEAM WAS TESTED WITH ALL FOUR COMBINATIONS OF THE TWO MESSAGE CHANNELS ASSIGNED TO INDIVIDUAL TEAM MEMBERS. HALF THE TEAMS COULD INTERRUPT THEIR PARTNERS AT ANY TIME: HALF COULD NOT. DEPENDENT MEASURES WERE TIME TO SOLUTION, NUMBER OF MESSAGES EXCHANGED, TOTAL NUMBER OF WORDS USED PER TEAM, MESSAGE LENGTH, MESSAGES COMMUNICATED PER MINUTE OF CHANNEL TIME, AND WORDS COMMUNICATED PER MINUTE OF CHANNEL TIME. THE RESULTS SHOW THAT COMMUNICATION BY VOICE IS MUCH MORE RAPID AND WORDY THAN IS COMMUNICATION BY TYPEWRITER. SUBJECTS THE FREEDOM TO INTERRUPT HAD NO EFFECT ON THE TIME REQUIRED TO SOLVE PROBLEMS, ON THE NUMBER OF WORDS USED IN THE SOLUTION OF PROBLEMS, OR ON THE RATE AT WHICH WORDS WERE COMMUNICATED. WHEN SUBJECTS HAD THE FREEDOM TO INTERRUPT, THEY "PACKAGED" THEIR WORDS DIFFERENTLY: THEY EXCHANGED MORE MESSAGES, MESSAGES WERE SHORTER, AND MESSAGES WERE EXCHANGED WITH GREATER FREQUENCY PER UNIT TIME. PRACTICE EFFECTS WERE ALMOST ENTIRELY ABSENT. A NUMBER OF SIGNIFICANT DIFFERENCES WERE ATTRIBUTABLE TO THE PROBLEMS AND THE JOBS ASSIGNED TO THE TWO COMMUNICATORS. (A) 32P, OR.

COMMENTS:

LIKE SIMILAR STUDIES COMDUCTED BY CHAPANIS AND HIS COLLEAGUES AT JOHNS HOPKINS UNIVERSITY, THIS EXPERIMENT DEMONSTRATES THAT CUMMUNICATION MODE SIGNIFICANTLY AFFECTS PROBLEM SOLVING PERFORMANCE. THE FINDING THAT THE ABILITY OF SUBJECTS TO INTERRUPT EACH OTHER DOES NOT AFFECT THE TIME REQUIRED TO SOLVE PROBLEMS IS INTERESTING, BUT MAY NOT GENERALIZE TO MAN-COMPUTER DIALOGUES. FOR EXAMPLE, ONE SUBJECT MAY INTERRUPT HIS OR HER PARTNER WHEN HE OR SHE IS FAIRLY CONFIDENT WHAT THE REMAINDER OF THE COMMUNICATION WOULD BE. SUCH ACCURATE PREDICTIONS WOULD NOT BE EXPECTED OF THE COMPUTER SIDE OF THE INTERFACE AND THE HUMAN USER MAY NOT BE ABLE TO PREDICT THE COMPUTER'S RESPONSES AS EASILY AS THOSE OF A FELLOW SUBJECT. ON THE OTHER HAND, A CAPABILITY FOR THE OPERATOR TO INTERRUPT COMPUTER MESSAGES IS RELATIVELY EASY TO IMPLEMENT AND MIGHT BE WORTHWHILE. AS INSERTLY PROVIDED IN MANY SYSTEMS, THIS FUNCTION DOES MORE THAN JUST INTERRUPT A SINGLE TRANSMISSION.

OTHER PERSONAL DIALOGUE
CHAPANIS, A., PARRISH, R.N., OCHSMAN, R.B., & WEEKS, G.D. STUDIES IN
INTERACTIVE COMMUNICATION: II. THE EFFECTS OF FOUR COMMUNICATION MODES ON
THE LINGUISTIC PERFORMANCE OF TEAMS DURING COOPERATIVE PROBLEM SOLVING.
HUMAN FACTORS, 1977, 19, 101-126.

DESCRIPTION: TWO-MAN TEAMS SOLVED CREDIBLE, "REAL WORLD" PROBLEMS FOR WHICH COMPUTER ASSISTANCE HAS BEEN OR COULD BE USEFUL. CONVERSATIONS WERE CARRIED ON IN ONE OF FOUR MODES OF COMMUNICATION: (1) TYPEWRITING, (2) HANDWRITING, (3) VOICE, AND (4) NATURAL, UNRESTRICTED COMMUNICATION. BOTH EXPERIENCED AND INEXPERIENCED TYPISTS WERE TESTED IN THE TYPEWRITING MODE. PERFORMANCE WAS ASSESSED ON THREE CLASSES OF DEPENDENT MEASURES: TIME TO SOLUTION, BEHAVIORAL MEASURES OF ACTIVITY, AND LINGUISTIC MEASURES. SIGNIFICANT DIFFERENCES AMONG THE COMMUNICATION MODES WERE FOUND IN EACH OF THE THREE CLASSES OF DEPENDENT VARIABLE. THIS RESULTS OF THE LINGUISTIC ANALYSES. THIS PAPER IS CONCERNED MAINLY WITH THE LINGUISTIC PEERFORMANCE WAS ASSESSED WITH 182 MEASURES, MOST OF WHICH TURNED OUT TO BE REDUNDANT AND SOME OF WHICH WERE USELESS OR MEANINGLESS. THOSE THAT REMAIN SHOW THAT ALTHOUGH THOSE THAT REMAIN SHOW THAT ALTHOUGH PROBLEMS CAN BE SOLVED FASTER IN THE ORAL MODES THAN IN THE HARD-COPY MODES, THE ORAL MODES ARE CHARACTERIZED BY MANY MORE MESSAGES, SENTENCES, WORDS, AND UNIQUE WORDS; MUCH HIGHER COMMUNICATION RATES; BUT LOWER TYPE-TOKEN RATIOS. ALTHOUGH A NUMBER OF SIGNIFICANT PROBLEM AND JOB ROLE EFFECTS WERE FOUND, THERE WERE RELATIVELY FEW SIGNIFICANT INTERACTIONS OF MODES WITH THESE VARIABLES. IT APPEARS, THEREFORE, THAT THE MODE EFFECTS HOLD WITH THESE VARIABLES. IT APPEARS, THEREFORE, THAT THE MODE EFFECTS HOLD FOR BOTH PROBLEMS AND FOR BOTH JOB ROLES ASSIGNED TO THE SUBJECTS. (A) 26P. 8R.

COMMENTS:

THIS IS A RE-ANALYSIS OF DATA FROM AN EXPERIMENT ORIGINALLY REPORTED BY A. CHAPANIS, R.B. OCHSMAN, R.N. PARRISH, AND G.D. WEEKS (1972). THE ORIGINAL ANALYSIS WAS PRIMARILY CONCEPNED WITH ACTIVITY ANALYSIS DATA THAT INDICATED THE PROPORTION OF TIME SPENT BY SUBJECTS IN PRE-DEFINED TYPES OF ACTIVITY. THE PRESENT ANALYSIS WAS CONCERNED WITH VARIOUS LINGUISTIC MEASURES. OF THE 182 MEASURES CONSIDERED, ONLY SEVEN WERE FOUND TO BE BOTH PRACTICALLY AND STATISTICALLY SIGNIFICANT. ALTHOUGH SUCH A SMALL NUMBER OF SIGNIFICANT EFFECTS COULD EASILY BE ATTRIBUTED TO CHANCE, THE 182 DEFINED MEASURES WERE NOT TOTALLY INDEPENDENT AND THE SIGNIFICANT EFFECTS FOUND ARE FAIRLY GENERAL AND EASILY UNDERSTOOD MEASURES OF LINGUISTIC PERFORMANCE. THIS PAPER IS ONE OF A SERIES BY CHAPANIS AND HIS COLLEAGUES. IN ALL STUDIES, A PRIMARY FINDING IS THAT FACE-TO-FACE OR VOICE COMMUNICATION MODES FACILITATE TWO-PERSON COOPERATIVE PROBLEM SOLVING.

94 GUIDELINES FOR MAN-COMPUTER DIALOGUE
CHERITON, D.R. MAN-MACHINE INTERFACE DESIGN FOR TIMESHARING SYSTEMS. IN ACM
'76: PROCEEDINGS OF THE ANNUAL CONFERENCE. NEW YORK: ASSOCIATION FOR COMPUTING MACHINERY, 1976, 362-366.
DESCRIPTION:

THIS PAPER PRESENTS A DESIGN APPROACH AND DESIGN CRITERIA FOR THE MAN-MACHINE INTERFACE IN TIMESHARING SYSTEMS. A CONCEPTUAL VIEW OF TIMESHARING IS OUTLINED, FOCUSING ON THE INTERFACE BETWEEN THE USER AND THE CAPABILITIES OF THE SYSTEM. WE CONSIDER USER NEEDS AND REQUIREMENTS FOR THIS INTERFACE AND SUGGEST DESIGN GUIDELINES AND APPROACHES TO MEET THESE NEEDS. FINALLY, WE PROPOSE A MODEL ON WHICH DESIGN AND DESIGN STANDARDIZATION MIGHT BE BASED AND BRIEFLY SKETCH A DESIGN METHODOLOGY. (A) 5P, 13R.

THE THESIS OF THIS PAPER IS THAT INTERFACE DESIGN SHOULD BE THE FIRST STEP IN DESIGNING AN INTERACTIVE SYSTEM. SEVERAL DESIRABLE PROPERTIES FOR AN INTERFACE THAT IS COMPATIBLE AND COMPLEMENTARY TO THE USER AND THAT MINIMIZES THE MENTAL LOAD ON THE USER ARE PROPOSED AND GUIDELINES FOR IMPLEMENTING SUCH AN INTERFACE ARE GIVEN. ALTHOUGH THE PRINCIPLES (SYSTEM SHOULD BE SIMPLE, RESPONSIVE, ETC.) AND GUIDELINES (AVOID IRRELEVANT INFORMATION, SUPPLY IMMEDIATE, UNAMBIGUOUS FEEDBACK, ETC.) ARE QUITE REASONABLE IN TERMS OF WHAT WE KNOW ABOUT MAN-COMPUTER INTERACTION, THEY ARE ALSO QUITE BROAD AND GENERAL. A MORE EXTENSIVE AND DETAILED SET OF GUIDELINES WILL BE FOUND IN S.E. ENGEL AND R.E. GRANDA (1975). FOR A BRIEF INTRODUCTION TO THE GENERAL PHILOSOPHY UNDERLYING SUCH GUIDELINES, HOWEVER, THIS PAPER IS QUITE GOOD.

95 MAN-COMPUTER DIALOGUE IN AUTOMATED CHECKOUT SYSTEMS
CHESLER, L., & TURM, R. SOME ASPECTS OF MAN-COMPUTER COMMUNICATION IN ACTIVE
MONITORING OF AUTOMATED CHECKOUT (TECHNICAL REPORT P-3522). SANTA MONICA,
CALIFORNIA: RAND CORP., MARCH 1967 (ALSO PRESENTED AT FOURTH SPACE CONGRESS,
COCOA BEACH, FLORIDA, APRIL 1967). (NTIS NO. AD 648553)
DESCRIPTION:

REQUIREMENTS FOR ACTIVE PARTICIPATION BY TEST PERSONNEL IN MONITORING AUTOMATED CHECKOUT OPERATIONS ARISE WHENEVER HAZARDOUS CONDITIONS EXIST, TIGHT TIME SCHEDULES MUST BE MET, AND COSTS OF FAILURE ARE HIGH. UNDER THESE CIRCUMSTANCES THE GOALS OF A HUMAN MONITOR COULD BE TO MAINTAIN CONTEXT WITH THE PROGRESS OF THE CHECKOUT OPERATIONS AND TO DETECT AND REACT TO MALFUNCTIONS IN CHECKOUT EQUIPMENT, INCORRECT DESIGN OR EXECUTION OF THE CHECKOUT PROGRAMS, AND UNEXPECTED EVENTS THAT THE LATTER HAVE NOT BEEN DESIGNED TO HANDLE.

THE HUMAN MONITOR'S EFFECTIVENESS IN PERFORMING THESE TASKS DEPENDS DIRECTLY ON WHAT INFORMATION IS AVAILABLE TO HIM AND HOW IT IS PRESENTED. DISPLAYS THAT USE SIMPLE CODING AND FORMATTING TO INCREASE INFORMATION EXTRACTABILITY AND THAT CONTAIN ADEQUATE ANTICIPATORY AND ALERTING INFORMATION MAY BE ESSENTIAL FOR REAL-TIME INTERACTION WITH AUTOMATED CHECKOUT OPERATIONS.

AS AN EXAMPLE OF EXTRACTABLE INFORMATION PRESENTATION, WE WILL DISCUSS A "DYNAMIC NETWORK" DISPLAY OF CHECKOUT OPERATIONS. SUCH A DISPLAY WOULD PERMIT A MONITOR TO DETERMINE AT A GLANCE THE STATUS OF THE CHECKOUT PROCESS THE PROGRAMMING TASK FOR THE DISPLAY CAN BE GREATLY EASED BY USE OF A DIGITAL COMPUTER EQUIPPED WITH GRAPHIC INPUT DEVICES. (A) 35P, 13R.

COMMENTS:

AUTOMATED CHECKOUT, OR TEST, PROCEDURES FOR COMPLEX SYSTEMS ARE INTENDED TO AID, NOT REPLACE, THE HUMAN OPERATOR. THIS PRESENTS A RATHER UNIQUE PROBLEM SOLVING SITUATION. WHILE THE HUMAN OPERATOR IS STILL RESPONSIBLE FOR THE CORRECT AND SAFE PERFORMANCE OF CHECKOUT OPERATIONS AND IS EXPECTED TO INTERCEDE WITH AUTOMATED OPERATIONS TO INSURE THAT THESE CONDITIONS ARE SATISFIED, THE OPERATOR DOES NOT DIRECTLY CONTROL ALL CHECKOUT OPERATIONS. THAT IS, ALTHOUGH THE OPERATOR DOES NOT DIRECTLY CONTROL CHANGES IN THE TEST ENVIRONMENT, HE MUST MAINTAIN AWARENESS OF THE STATE OF THIS ENVIRONMENT, HE MUST MAINTAIN AWARENESS OF THE STATE OF THIS ENVIRONMENT SO THAT HE CAN EFFECTIVELY DETERMINE HOW AND WHEN HE NEEDS TO ASSUME CONTROL. A USEFUL AID IN THIS CASE WOULD BE A GISPLAY THAT ALLOWS THE OPERATOR TO QUICKLY DETERMINE THE PRESENT STATUS OF THE TEST ENVIRONMENT, THE ACTIONS THAT CAUSED THIS STATUS, AND THE ACTIONS THAT WOULD MORMALLY BE PERFORMED NEXT. THIS PAPER DESCRIBES SUCH A DISPLAY WHICH HELPS THE OPERATOR MAINTAIN CONTEXT BY PROVIPING TEMPORAL INFORMATION. THIS DISPLAY SHOULD BE USEFUL IN MONITORING ANY AUTOMATED PROCESS.

96 COLOR CODING

CHRIST, R.E. REVIEW AND ANALYSIS OF COLOR CODING RESEARCH FOR VISUAL DISPLAYS. HUMAN FACTORS, 1975, 17, 542-570.

DESCRIPTION:

THE EXPERIMENTAL LITERATURE ON THE EFFECTS OF COLOR ON VISUAL SEARCH AND IDENTIFICATION PERFORMANCE WAS REVIEWED. FORTY-TWO STUDIES PUBLISHED BETWEEN 1952 AND 1973 WERE LOCATED THAT GAVE RESULTS WHICH COULD BE USED TO DETERMINE THE EFFECTIVENESS OF COLOR CODES RELATIVE TO VARIOUS TYPES OF ACHROMATIC CODES. QUANTITATIVE ANALYSES OF THESE RESULTS INDICATED THAT COLOR MAY BE A VERY EFFECTIVE PERFORMANCE FACTOR UNDER SOME CONDITIONS, BUT THAT IT CAN BE DETRIMENTAL UNDER OTHERS. TENTATIVE CONCLUSIONS ABOUT THE NATURE OF THESE CONDITIONS WERE DERIVED FROM THE RESULTS. A GUIDE FOR DESIGN FECISIONS AND AN INDICATION OF KNOWLEDGE GAPS ARE ALSO PROVIDED. (A) 29P, 164R.

COMMENTS:

THIS EXCELLENT PAPER PRESENTS A THOROUGH AND UP-TO-DATA REVIEW OF THE LITERATURE ON THE EFFECTS OF COLOR CODING IN VISUAL DISPLAYS AND ALSO PRESENTS A CONCISE AND CLEAR SUMMARY OF THE PRINCIPAL RESULTS OF THESE STUDIES. THIS PROVIDES A GOOD REFERENCE DOCUMENT ON THE USE OF COLOR CODING IN VISUAL DISPLAYS. BASED ON A REVIEW OF 42 EXPERIMENTAL STUDIES, REDUNDANT, PARTIALLY REDUNDANT, AND NONREDUNDANT COLOR CODING WERE FOUND TO IMPROVE PERFORMANCE IN SEARCH TASKS WITH HIGH CONSISTENCY. MAGNITUDE OF IMPROVEMENT VARIES WITH THE ALTERNATIVE CODING TECHNIQUES WITH WHICH COLOR CODING WAS COMPARED AND THE WAY IN WHICH COLOR CODING WAS EMPLOYED. RESULTS IN IDENTIFICATION TASKS WERE LESS CONSISTENT. COLOR CODING SOMETIMES HELPED, SOMETIMES HINDERED PERFORMANCE HERE. AGAIN, THOUGH, THERE ARE SOMEWHAT CONSISTENT RELATIONSHIPS BETWEEN THE EFFECTS OF COLOR CODING AND THE WAY IN WHICH IT IS USED. THE AUTHOR ALSO INDICATES AREAS IN WHICH ADDITIONAL RESEARCH IS NEEDED AND PRESENTS A BIBLIOGRAPHY OF LITERATURE PERTAINING TO THE USE OF COLOR IN DISPLAYS. THIS PAPER IS FAIRLY DETAILED, AND MAY CONTAIN MORE INFORMATION THAN SOME READERS WANT TO ABSORB. ON THE OTHER HAND, IT IS THE OUTSTANDING PAPER ON COLOR CODING, AND SHOULD BE USEFUL TO RESEARCHERS AND PRACTITIONERS ALIKE.

97 COLOR CODING

CHRIST, R.E., & CORSO, G.M. COLOR RESEARCH FOR VISUAL DISPLAYS (REPORT NO. ONR-CR213-102-3). LAS CRUCES, NEW MEXICO: NEW MEXICO STATE UNIVERSITY, DEPARTMENT OF PSYCHOLOGY, JULY 1975. DESCRIPTION:

A SERIES OF EXPERIMENTS ARE REPORTED WHICH USE HIGHLY PRACTICED SUBJECTS TO INVESTIGATE THE EFFECTIVENESS OF COLOR CODING RELATIVE TO LETTERS, DIGITS, AND FAMILIAR GEOMETRIC SHAPES. THESE EXPERIMENTS WERE CONCERNED WITH UNI-DIMENSIONAL AND BIDIMENSIONAL DISPLAYS AND RELATIVELY SIMPLE SINGLE TASKS (CHOICE REACTION TIME, SEARCH AND LOCATE, AND MULTIPLE TARGET IDENTIFICATION). THE RESULTS ARE PRESENTED IN A FORMAT WHICH MAY BE USED AS A PRACTICAL GUIDE FOR WHEN AND WHERE TO USE COLOR IN DISPLAYS. IN ADDITION, SEVERAL ISSUES OF MORE GENERAL THEORETICAL INTEREST ARE DISCUSSED. (A) 108P, 2R.

COMMENTS:

IN A FAIRLY EXTENSIVE REVIEW OF THE LITERATURE ON COLOR CODING, R.E. CHRIST (1975) NOTED LIMITATIONS IN EXISTING STUDIES THAT PREVENT A DEFINITIVE EVALUATION OF THE EFFECTS OF COLOR CODING. THE PRINCIPAL LIMITATIONS WERE THE USE OF UPPRACTICED SUBJECTS AND THE USE OF A SINGLE EXPERIMENTAL DISPLAY. THE EXPERIMENTS REPORTED IN THIS FAPER WERE INTENDED TO OVERCOME THESE LIMITATIONS. THESE EXPERIMENTS WERE CAREFULLY CONDUCTED AND ANALYZED AND ARE REPORTED CLEARLY AND IN GREAT DETAIL. THE AUTHORS POINT OUT THE EFFECTIVENESS OF COLOR CODING UNDER A VARIETY OF CONDITIONS AND INDICATE AREAS WHERE ADDITIONAL RESEARCH IS NEEDED.

98 COMPUTER-AIDED PLANNING

CITRENBAUM, R.L. PLANNING AND ARTIFICIAL INTELLIGENCE. IN H. SACKMAN & R.L. CITRENBAUM (EDS.), ONLINE PLANNING: TOWARDS CREATIVE PROBLEM SOLVING. ENGLEWOOD CLIFFS, NEW JERSEY: PRENTICE-HALL, 1972, 135-164.

DESCRIPTION:

AMONG THE INITIAL PROBLEMS IN DEVELOPING ONLINE COMPUTER SYSTEMS FOR PLANNING IS THE IDENTIFICATION OF DESIRED CAPABILITIES FOR SUCH SYSTEMS, AND THE SPECIFICATION OF TECHNIQUES AND METHODS USEFUL FOR IMPLEMENTATION. TO PROVIDE BACKGROUND ON THE OVERALL PROBLEM OF PLANNING, THE PAPER OPENS WITH AN OVERVIEW OF GENERALIZED PLANNING. A SUBJECTIVE DEFINITION OF GENERALIZED PLANNING IS INCLUDED ALONG WITH THE ROLE AND SCOPE OF PLANNING. THE HIERARCHICAL STRUCTURE OF PLANNING IS DISCUSSED, AND INTRODUCTORY THOUGHTS ON COMPUTER-AIDED PLANNING ARE PRESENTED. NEWLY EMERGING DISCIPLINES ARE REVIEWED, AND SEVERAL GENERAL-PURPOSE, PROBLEM-SOLVING TECHNIQUES ARE CONSIDERED BRIEFLY.

THE REMAINDER OF THE CHAPTER IS DEVOTED TO ARTIFICIAL INTELLIGENCE AS A BASIS FOR TECHNIQUES IN COMPUTER PLANNING. THE FIELD OF ARTIFICIAL INTELLIGENCE IS SURVEYED IN ITS PRIMARY AREAS OF STUDY. AFTER CRITICISM OF APPROACHES TAKEN AND GENERAL ASSUMPTIONS MADE BY WORKERS IN THE FIELD, THE BASIC TECHNIQUES UTILIZED IN ARTIFICIAL INTELLIGENCE ARE EXTRACTED AND BRIEFLY ANALYZED.

THE PRIMARY CONCLUSION IS THAT PLANNING PROBLEMS FALL INTO THE REALM OF NONFORMAL, ILL-DEFINED PROBLEMS, PRECISELY THE AREA IN WHICH THE PAYOFF IN ARTIFICIAL INTELLIGENCE RESEARCH HAS BEEN MINIMAL. IT IS SUGGESTED THAT INTERACTIVE MAN-MACHINE SYSTEMS MAY PROVIDE AN ANSWER TO THIS DIFFICULTY, AND MAN-MACHINE SYSTEMS ARE DISCUSSED RELATIVE TO THE INDEPENDENT CAPABILITIES OF BOTH MAN AND MACHINE. (A) 30P, 48R.

COMMENTS:

THIS PAPER PROVIDES A GOOD INTRODUCTION TO THE NATURE OF THE PLANNING PROCESS. ALTHOUGH THE REVIEW OF THE ARTIFICIAL INTELLIGENCE LITERATURE IS VERY BRIEF AND SOME OF THE CRITICISMS OF ARTIFICIAL INTELLIGENCE SYSTEMS DO NOT NECESSARILY APPLY TO MORE RECENTLY DEVELOPED SYSTEMS, THE AUTHOR IS PROBABLY CORRECT IN ASSUMING THAT PLANNING, AS A TASK, IS NOT WELL SUITED FOR A STRICTLY ARTIFICIAL INTELLIGENCE APPROACH. WHILE THE AUTHOR NOTES THAT A MAN-COMPUTER PLANNING SYSTEM COULD BE VERY EFFECTIVE, HE DOES NOT EXPLORE THE NATURE OF SUCH A SYSTEM IN ANY DETAIL. SOME INTERESTING COMMENTS ON THIS TOPIC, BASED LARGELY ON AN ARTIFICIAL INTELLIGENCE APPROACH, HAVE BEEN PRESENTED BY A. NEWELL (1965).

MAN-COMPUTER DIALOGUE

CLAPP, L.C. (ED.). MAN-COMPUTER INTERACTION AND CONTEXT PROGRAMMING (TECHNICAL REPORT R102-6). NEWTON, MASSACHUSETTS: COMPUTER RESEARCH CORP., JULY 1970. (NTIS NO. AD 714232) DESCRIPTION:

THIS REPORT IS CONCERNED WITH THE COMMUNICATION BETWEEN MAN AND THE COMPUTER SYSTEMS HE USES FOR PROBLEM SOLVING AND MANAGEMENT PLANNING.

TO BRIDGE THE GAP BETWEEN PROBLEM SOLVING NEEDS AND THE ABILITY OF PROBLEM SOLVERS TO WRITE THEIR OWN PROGRAMS, THE TREND HAS BEEN TO CREATE PRE-PACKAGED PROGRAMS WHICH CAN SOLVE A CLASS OF PROBLEMS ONCE THE PERTINENT DATA HAS BEEN SUPPLIED.

ONE IMPEDIMENT TOWARD THE DEVELOPMENT OF BETTER PROBLEM SOLVING TOOLS WHICH WILL OPERATE IN CONJUNCTION WITH ON-LINE COMPUTER SYSTEMS IS A METHODOLOGY FOR STRUCTURING THE DIALOGUE BETWEEN THE PROBLEM SOLVER AND HIS MACHINE.

A SERIES OF GENERALIZED DIALOGUE HANDLING ROUTINES WAS PROGRAMMED FOR A TIME-SHARING SYSTEM OPERATING OF A SCIENTIFIC DATA SYSTEMS COMPUTER (SDS-940). THE GENERAL SET OF ROUTINES IS CALLED THE COMMAND PACKAGE.

THE COMMAND PACKAGE IS THEN USED IN SEVERAL DIFFERENT APPLICATIONS AREAS DRAWN FROM MATHEMATICS, ENGINEERING AND GENERAL MODELING AND SIMULATION. (A) 49P. 7R.

COMMENTS:

THE AUTHOR OF THIS PAPER IS QUITE CORRECT IN ASSERTING THAT THERE IS A SERIOUS GAP BETWEEN PROBLEM SOLVING NEEDS AND THE ABILITY OF PROBLEM SOLVERS TO WRITE THEIR OWN PROGRAMS. THE USE OF PRE-PACKAGED PROGRAMS FOR A GIVEN CLASS OF PROBLEMS, WHILE USEFUL, DOES NOT ADEQUATELY BRIDGE THIS GAP. MANY REAL-WORLD PROBLEMS, THE PROBLEM SOLVER HAS DIFFICULTY IN IDENTIFYING AND DEFINING THE PROBLEM WITH WHICH HE IS CONFRONTED AND MAY WISH TO EXPLORE ALTERNATIVE APPROACHES RATHER THAM BEING PRESENTED WITH A SINGLE, THIS PAPER DOES NOT CONSIDER THE TYPE OF PROBLEM PRE-DETERMINED SOLUTION. SOLVING AIDS THAT WOULD BE USEFUL IN THIS SITUATION. IN ADDITION, THIS PAPER FOCUSES ON THE TYPE OF PROBLEM SOLVING COMMAND THAT CAN BE MADE ACCEPTABLE TO A COMPUTER. WHILE THIS IS, OF COURSE, A NECESSARY CONSIDERATION, IT MAY PROVE MORE EFFECTIVE TO INTIAL FOCUS ON THE TYPE OF COMMAND THAT THE PROBLEM SOLVER NEEDS AND CAN USE EFFECTIVELY. THE MAJOR SECTION OF THIS PAPER DESCRIBES A SERIES OF DIALOGUE HANDLING ROUTINES.

100 NATURAL-LANGUAGE PROCESSING CLARK, L.M. COMPUTER PROGRAMS THAT UNDERSTAND ORDINARY NATURAL LANGUAGE. COMPUTERS AND PEOPLE, APRIL 1975, 24(4), 14-23.

DESCRIPTION: SEVERAL COMPUTER PROGRAMS THAT "UNDERSTAND" WHAT A HUMAN "SAYS" HAVE BEEN DEVELOPED. HOWEVER, THE PROBLEM OF HAVING A COMPUTER DEAL EASILY AND WELL WITH A LARGE SET OF WORDS AND SENTENCES IN ORDINARY NATURAL LANGUAGE HAS NOT YET BEEN SOLVED. THE MAIN REASON FOR THIS SHORTCOMING IS THE USE OF UNPRODUCTIVE DIRECTIONS OF ATTACK. THIS PAPER DESCRIBES A NEW APPROACH TO THIS PROBLEM THAT APPEARS TO BE MORE PROMISING. 7P, OR.

COMMENTS:

THE AUTHOR ASSUMES THAT WORDS CAN BE DIVIDED INTO TWO CLASSES: THOSE THAT HAVE MEANING AND ARE USED ONLY IN A SPECIFIC CONTEXT AND THOSE THAT ARE USED IN SEVERAL CONTEXTS, ALTHOUGH THEIR MEANINGS MAY STILL BE CONTEXT-SPECIFIC. ALTHOUGH THIS MAY BE A USEFUL APPROACH TO NATURAL LANGUAGE MAN-COMPUTER DIALOGUE, THIS PAPER DOES NOT PROVIDE STRONG SUPPORT. THI BASIC IDEA APPEARS TO BE TO DEVELOP A COMPUTER SYSTEM THAT CAN CONVERT "WORDS" INTO "IDEAS" AND THEN DEAL WITH THE IDEAS RATHER THAN THE WORDS. HOW THIS IS TO BE DONE AND THE ADVANTAGES THAT WOULD BE DERIVED ARE NOT CLEARLY SPECIFIED.

101 INFORMATION RETRIEVAL SYSTEMS
CLARKE, D.C. QUERY FORMULATION FOR ON-LINE REFERENCE RETRIEVAL: DESIGN
CONSIDERATIONS FROM THE INDEXER/SEARCHER VIEWPOINT. PROCEEDINGS OF THE
AMERICAN SOCIETY FOR INFORMATION SCIENCE, 1970, 7, 83-86.
DESCRIPTION:

IN THIS PAPER, CONSIDERATION IS GIVEN TO THE DEPENDENCY THAT EXISTS BETWEEN THE INDEXING PROCESS AND QUERY FORMULATION PROCESS IN A REFERENCE RETRIEVAL ENVIRONMENT. DESIGN ALTERNATIVES FOR QUERY FORMULATION METHODS AND THE DEGREE TO WHICH THEY MAKE USE OF THIS DEPENDENCY ARE DISCUSSED. EXAMPLES SHOWING HOW THREE SEPARATE DESIGNS MIGHT BE INTEGRATED INTO THE NEGOTIATED SEARCH FACILITY, AN ON-LINE DOCUMENT REFERENCE RETRIEVAL SYSTEM, ARE GIVEN AND A DISCUSSION OF THE DESIGN WHICH HAS BEEN IMPLEMENTED IS PRESENTED. (A)

COMMENTS:

THIS PAPER PRESENTS A LIST OF DESIGN GOALS DIRECTED AT MAKING INTERACTIVE INFORMATION RETRIEVAL COMPATIBLE WITH THE ABILITIES AND REQUIREMENTS OF POTENTIAL USERS AND EVALUATES THREE PROPOSED DESIGNS WITH RESPECT TO THESE GOALS. ALTHOUGH THIS LIST IS NOT COMPLETE, THE GOALS DESCRIBED ARE BOTH ATTAINABLE AND DESIRABLE. THE AUTHOR BRIEFLY CONSIDERS THE DIFFICULTY OF DESIGNING A SYSTEM THAT MEETS THE REQUIREMENTS OF BOTH EXPERIENCED AND NOVICE USERS. THE ASSUMPTION IS THEN MADE THAT THE SEARCH BEHAVIOR OF THESE TWO GROUPS WILL BE IDENTICAL OR VERY SIMILAR. SUCH A ASSUMPTION CAN HAVE LARGE EFFECTS ON SYSTEM DESIGN AND USER ACCEPTANCE AND SHOULD NOT BE MADE WITHOUT EMPIRICAL SUPPORT. IT IS NOT CLEAR FROM THE BRIEF DESCRIPTION PRESENTED IN THIS PAPER WHETHER THE PROPOSED DESIGN OFFERS THE SIMPLICITY REQUIRED BY THE NOVICE USER WHILE STILL ALLOWING MORE EXPERIENCED USERS TO USE MORE COMPLEX SEARCH STRATEGIES.

102 QUERY FORMULATION DIALOGUES
CODD, E.F. SEVEN STEPS TO RENDEZVOUS WITH THE CASUAL USER (TECHNICAL REPORT RJ-1333). SAN JOSE, CALIFORNIA: IBM RESEARCH LABORATORY, JANUARY 1974.
DESCRIPTION:

IF WE ARE TO SATISFY THE NEEDS OF CASUAL USERS OF DATA BASES, WE MUST BREAK THROUGH THE BARRIERS THAT PRESENTLY PREVENT THESE USERS FROM FREELY EMPLOYING THEIR NATIVE LANGUAGES (E.G., ENGLISH) TO SPECIFY WHAT THEY WANT. IN THIS PAPER WE INTRODUCE AN APPROACH (ALREADY PARTIALLY IMPLEMENTED) THAT PERMITS A USER TO ENGAGE A RELATIONAL DATA BASE SYSTEM IN A DIALOG WITH THE OBJECTIVE OF ATTAINING AGREEMENT BETWEEN THE USER AND THE SYSTEM AS TO THE USER'S NEEDS. THE SYSTEM ALLOWS THIS DIALOG TO BE IN UNRESTRICTED ENGLISH SO LONG AS IT IS ABLE TO EXTRACT A VIABLE QUANTUM OF INFORMATION FROM THE USER'S RESPONSE. IMMEDIATELY IF THE SYSTEM FINDS THAT THE USER'S RESPONSE IS INADEQUATELY DECIPHERABLE OR CLEARLY INADEQUATE, IT CONFRONTS THE USER WITH A MULTIPLE CHOICE QUESTION. AS SOON AS POSSIBLE, THE CONVERSATION REVERTS TO UNRESTRICTED ENGLISH. (A)

COMMENTS:

THE AUTHOR OF THIS PAPER NOTES THAT PREVIOUS WORK ON NATURAL-LANGUAGE QUERY SYSTEMS HAS BEEN BASED ON TWO UNSTATED ASSUMPTIONS. THE FIRST IS THAT A USER CAN FORMULATE A QUERY THAT ACCURATELY EXPRESSES HIS INTENT ON HIS FIRST ATTEMPT AND THE SECOND IS THAT IT IS THE RESPONSIBILITY OF THE USER, RATHER THAN THE SYSTEM, TO RE-STATE ANY QUERY THAT IS BEYOND THE COMPREHENSION ABILITIES OF THE SYSTEM. CLEARLY, NEITHER ASSUMPTION IS DESIRABLE. THE "RENDEVOUS" SYSTEM DESCRIBED IN THIS PAPER IS A SEMANTICALLY-DRIVEN LANGUAGE PROCESSOR THAT USES A SERIES OF TRANSFORMATION HULES TO RECOGNIZE AND INTERPRET NATURAL LANGUAGE COMMANDS. ALTHOUGH THERE ASSUMPTIONS ON THE TYPE OF STATEMENT THE SYSTEM CAN PROCESS, THE USER CONSTRAINTS ON THE TYPE OF STATEMENT THE SYSTEM ATTEMPTS TO RESOLVE HULLIES IN AN UNOBTRUSIVE MANNER. THE EFFECTS ON THE USER WHO IS NOT ARE OF THE CONSTRAINTS ON THE SYSTEM'S ABILITIES IS AN AREA INVESTIGATED. THE SYSTEM UTILIZES A SIMPLE AND APPARENTLY HULLIPLE-CHOICE TECHNIQUE IN THOSE INSTANCES IN WHICH IT IS HEADOWNS IN THE NATURAL-LANGUAGE DIALOGUE. EXAMPLES ARE TO SECOND SOME THE SYSTEM UTILIZES AS IN THAT CONTEXT, HEADOWNS IN THE NATURAL-LANGUAGE DIALOGUE. EXAMPLES ARE THE SECOND SOME THE SYSTEM THAT THE RIVAL HERE APPEAR TO BE COMPATIBLE WITH THE RIVAL

103 USE OF INTERACTIVE GRAPHICS IN TEXT EDITING
COLEMAN, M.L. TEXT EDITING ON A GRAPHIC DISPLAY DEVICE USING HAND-DRAWN
PROOFREADERS SYMBOLS. IN M. FAIMAN AND J. NIEVERGELT (EDS.), PERTINENT
CONCEPTS IN COMPUTER GRAPHICS: PROCEEDINGS OF THE SECOND UNIVERSITY OF
ILLINOIS CONFERENCE ON COMPUTER GRAPHICS. URBANA, ILLINOIS: UNIVERSITY OF
ILLINOIS, 1969, 282-290.
DESCRIPTION:

AUTOMATIC TEXT EDITING REQUIRES THE SPECIFICATION OF THE ACTION TO BE TAKEN AND THE PORTION OF THE TEXT TO WHICH THE ACTION IS TO BE APPLIED. WITH A KEYBOARD, WE MUST IDENTIFY THE SECTION OF TEXT TO BE EDITED AND LOCATE IT FOR THE COMPUTER BY LINE NUMBR OR CONTEXT. WITH A GRAPHIC DISPLAY UNIT, HOWEVER, WE NEED ONLY IDENTIFY THE SECTION OF TEXT AND THE COMPUTER DOES THE LOCATING. THIS PAPER DESCRIBES A GRAPHICAL TEXT EDITING SYSTEM THAT ALLOWS THE USER TO USE HAND-DRAWN PROOFREADER'S SYMBOLS.

9P, 8R.

COMMENTS:

THIS PAPER DESCRIBES AN INTERESTING APPLICATION OF GRAPHICS DISPLAYS IN A TEXT EDITING TASK. A PRIMARY MOTIVATION UNDERLYING THE DEVELOPMENT OF THIS SYSTEM WAS TO DESIGN A SYSTEM THAT WAS "NATURAL" FOR USERS WITH NO PREVIOUS EXPERIENCE WITH COMPUTER SYSTEMS. SINCE USER ACCEPTANCE AND USER SATISFACTION ARE NOT DISCUSSED, IT CANNOT BE DETERMINED IF THIS OBJECTIVE WAS ACHIEVED.

104 NATURAL LANGUAGE DIALOGUE, SYSTEM DEVELOPMENT METHODS
COLLINS, A., WARNOCK, E.H., & PASSAFIUME, J.J. ANALYSIS AND SYNTHESIS OF
TUTORIAL DIALOGUES (REPORT 2789). CAMBRIDGE, MASSACHUSETTS: BOLT BERANEK AND
NEWMAN, INC., MARCH 1974 (ALSO IN G. BOWER (ED.), THE PSYCHOLOGY OF LEARNING
AND MOTIVATION, 1975, 9, 49-87).
DESCRIPTION:

IN THIS PAPER WE ATTEMPT TO ANALYZE THE STRATEGY BY WHICH TUTORS ADAPT THEIR TEACHING TO INDIVIDUAL STUDENTS, SO THAT WE CAN SYNTHESIZE THESE STRATEGIES IN A COMPUTER SYSTEM CALLED "SCHOLAR." TO FIND OUT WHAT STRATEGIES TUTORS USE, WE TAPE-RECORDED DIALOGUES BETWEEN VARIOUS TUTORS AND STUDENTS ON THE TOPIC OF SOUTH AMERICAN GEOGRAPHY. BECAUSE "SCHOLAR" IS A WELL-DEFINED PROGRAM, IT IS POSSIBLE TO ANALYZE SUCH ILL-DEFINED NATURALISTIC DATA IN PRECISE TERMS, WITH RESPECT TO THE STRUCTURE AND PROCESSING OF INFORMATION IN "SCHOLAR." WE ANALYZED THE DIALOGUES CONCENTRATING ON ONE ASPECT AT A TIME. BASED ON OUR ANALYZES, WE PROPOSE IN THIS PAPER SEVERAL HYPOTHESES ABOUT HOW THE TUTOR RELATES HIS TEACHING TO THE INDIVIDUAL STUDENT. WE SHOW HOW IN MODIFIED FORM WE HAVE IMPLEMENTED SOME OF THESE STRATEGIES IN "SCHOLAR." WE FURTHER ARGUE THAT THE ANALYTICAL METHOD EMPLOYED HERE COULD BE EXTENDED TO A WIDE RANGE OF CONVERSATIONAL SITUATIONS. THIS METHOD (DIALOGUE ANALYSIS) WOULD PERMIT PSYCHOLOGISTS TO STUDY QUESTIONS ABOUT THE INTERACTIVE ASPECTS OF HUMAN PROCESSING THAT CANNOT EVEN BE CONSIDERED WITH TRADITIONAL LABORATORY METHODS. (A) 78P, 18R.

COMMENTS:

"SCHOLAR" IS A MIXED-INITIATIVE, GENERATIVE COMPUTER-ASSISTED INSTRUCTION (CAI) SYSTEM. THIS PAPER IS CONCERNED WITH IMPROVING THE TUTORIAL TECHNIQUES USED BY SCHOLAR. THE AREAS CONSIDERED ARE TOPIC SELECTION, QUESTIONING STUDENTS ABOUT BASIC CONCEPTS, REVIEWING PREVIOUSLY PRESENTED MATERIAL, PROVIDING HINTS TO THE STUDENTS AND RESPONDING TO STUDENT ERRORS. THE TUTORIAL STRATEGIES DESCRIBED SEEM REASONABLE AND THEW SHOULD IMPROVE THE EFFECTIVENESS OF A CAI SYSTEM. ALTHOUGH THIS PAPER WOULD BE RELEVANT PRIMARILY TO THOSE INTERESTED IN CAI, IT ALSO ILLUSTRATES A NEAR-STATE-OF-THE ART NATURAL-LANGUAGE DIALOGUE SYSTEM AND DISCUSSES SOME OF THE PROPERTIES OF THE DIALOGUE WHICH IS POSSIBLE USING THE SYSTEM. SUCH DIALOGUE TECHNIQUES ARE PRESENTLY POSSIBLE ONLY IN HIGHLY LIMITED PROBLEM DOMAINS; IN ITS DOMAIN THE SCHOLAR SYSTEM IS QUITE EFFECTIVE. ON ANOTHER TOPIC, THE SYSTEM DEVELOPMENT METHODOLOGIES DESCRIBED HERE COULD USEFULLY BE APPLIED TO SYSTEM DESIGN. THIS METHOD, CALLED THE "ANALYTIC-SYNTHETIC" APPROACH COULD BE USED AS AN ITERATIVE DESIGN PROCEDURE. THE DESIRED SYSTEM FUNCTIONS ARE DETERMINED (ANALYZED) AND AN ATTEMPT IS MADE TO IMPLEMENT (SYNTHESIZE) THESE FUNCTIONS. IF THIS IMPLEMENTATION IS NOT SATISFACTORY, PROBLEM AREAS ARE IDENTIFIED AND ANALYZED AND THE IMPLEMENTATION IS MODIFIED. THIS HELPS TO DESIGNER TO IDENTIFY RELEVANT ASPECTS OF THE SYSTEM AND, ESPECIALLY IN AN INTERACTIVE SYSTEM, COULD LEAD TO A BETTER UNDERSTANDING OF USER THIS HELPS THE REQUIREMENTS. WHILE THIS SUGGESTION MAY SEEM FOREIGN TO THOSE RAISED IN THE PREVALENT "DO IT ONCE AND GET IT RIGHT" TRADITION, THERE IS REASON TO BELIEVE THAT AN ITERATIVE APPROACH BASED ON GOOD TOOLS AND DEVELOPMENT TECHNIQUES IS POTENTIALLY SUPERIOR.

105 OPERATING SYSTEM PROPERTIES
COMFORT, W.T. A COMPUTING SYSTEM DESIGN FOR USER SERVICE. AFIPS CONFERENCE
PROCEEDINGS, 1965, 27, 619-626.
DESCRIPTION:

THIS REPORT IS AN OVERVIEW OF THE MAJOR HARDWARE AND CONTROL PROGRAM CHARACTERISTICS OF THE IBM SYSTEM/360 MODEL 67 TIME SHARING SYSTEM. THE BASIC INTENT OF THIS SYSTEM IS TO PROVIDE A USER WITH WHAT APPEARS TO BE IMMEDIATE RESPONSE AND TO PROVIDE SELECTABLE PROCEDURES FOR CREATING, DEBUGGING AND EXECUTING PROGRAMS.

8P, 4R.

THE AUTHOR PROVIDES AN ADEQUATE, LOW-LEVEL DESCRIPTION OF THE HARDWARE AND SOFTWARE COMPONENTS OF THE SYSTEM DISCUSSED. HUMAN FACTORS ASPECTS OF TIME-SHARED SYSTEMS ARE CONSIDERED ONLY VERY BRIEFLY AND AT A SUPERFICIAL LEVEL.

106 PROPERTIES OF TACTICAL DISPLAYS

CONNELLY, E.M. MANNED SYSTEM PERFORMANCE AS A FUNCTION OF DISPLAY CHARACTERISTICS (TECHNICAL REPORT NO. OTR-62-77-1). VIENNA, VIRGINIA: OMNEMII, INC., JUNE 1977. DESCRIPTION:

IN MANNED SYSTEMS, PERFORMANCE CAN CHANGE SIGNIFICANTLY WITH CHANGES IN DISPLAY DESIGN. WITH TODAY'S COMPUTER AND DISPLAY TECHNOLOGY, IT IS POSSIBLE TO PROVIDE VIRTUALLY ANY DISPLAY FUNCTION DESIRED INCLUDING AUTOMATING MANY OF THE INFORMATION PROCESSING TASKS PREVIOUSLY PERFORMED BY THE HUMAN OPERATOR. HOWEVER, THE RELATIONSHIP BETWEEN DISPLAY DESIGN AND TOTAL SYSTEM (MAN AND MACHINE) PERFORMANCE MUST BE KNOWN IN ORDER TO SYSTEMATICALLY SELECT THE DISPLAY FEATURES.

SYSTEMATICALLY SELECT THE DISPLAY FEATURES.

A NEW HUMAN OPERATOR MODELING TECHNIQUE TERMED OPERATOR MEASURES AND CRITERIA (OMAC) WAS USED TO REPRESENT THE SHIP CONTROL PERFORMANCE OF THE OFFICER OF THE DECK (OOD). OMAC'S ARE MEASURES AND CRITERIA WHICH ARE DETERMINED BY CALCULATION TO BE THOSE OPTIMIZED BY THE OBSERVED OOD CONTROLLED SHIP RESPONSES. OMAC'S WERE DETERMINED FROM DATA OBTAINED FROM AN EXPERIMENT IN WHICH THREE DIFFERENT DISPLAYS WERE USED. WITH EACH OF THOSE DISPLAYS, OOD SUBJECTS DEMONSTRATING SUPERIOR PERFORMANCE RESULTED IN IDENTICAL CRITERIA, BUT AN APPARENTLY SELF-IMPOSED CONSTRAINT CALLED PURVIEW (RANGE FROM OWN SHIP WITHIN WHICH CONTACTS ARE PROCESSED BY THE OOD), WAS SHOWN TO BE DIFFERENT FOR EACH DISPLAY TYPE. PURVIEW IS SHOWN TO EXPLAIN DIFFERENCES IN PERFORMANCE WITH DIFFERENT DISPLAYS. THE PROPORTION OF OOD SUBJECTS DEMONSTRATING SUPERIOR PERFORMANCE IS ALSO SHOWN TO BE A FUNCTION OF DISPLAY TYPE. (A)

#### COMMENTS:

THE PRIMARY PURPOSE OF THIS RESEARCH IS TO EVALUATE A TECHNIQUE FOR DETERMINING THE RELATIONSHIP BETWEEN DISPLAY DESIGN AND TOTAL SYSTEM PERFORMANCE. IN MOST AUTOMATIC CONTROL SYSTEM DESIGN EFFORTS, CRITERIA ARE FIRST SELECTED AND SYSTEM RESPONSES ARE SELECTED TO OPTIMIZE THESE CRITERIA. IN THE APPROACH DESCRIBED HERE, STUDY STARTS WITH OBSERVED RESPONSES AND ATTEMPTS TO DETERMINE THE CRITERIA THAT ARE OPTIMIZED BY THESE RESPONSES. SINCE NO DIRECT COMPARISON WITH EXISTING TECHNIQUES IS PRESENTED, IT IS DIFFICULT TO EVALUATE THIS TECHNIQUE. ONE ADVANTAGE OVER EXISTING TECHNIQUES, IS THAT THIS TECHNIQUE ALSO PRODUCED LOW-LEVEL MODELS OF THE STRATEGIES USED BY HUMAN OPERATORS AND THESE MODELS MAY BE USEFUL IN THEIR OWN RIGHT.

107 KEYBOARD LAYOUT

CONRAD, R. SHORT-TERM MEMORY FACTOR IN THE DESIGN OF DATA-ENTRY KEYBOARDS: AN INTERFACE BETWEEN SHORT-TERM MEMORY AND S-R COMPATIBILITY. JOURNAL OF APPLIED PSYCHOLOGY, 1966, 50, 353-356. DESCRIPTION:

AN EXPERIMENT IN IMMEDIATE RECALL OF 8-DIGIT SEQUENCES WAS CARRIED OUT.
MODE OF RECALL WAS VIA A DATA-ENTRY KEYBOARD. TWO KEYBOARD LAYOUTS WERE
USED, ONE OF HIGH, ONE OF LOW COMPATIBILITY. THE LOW-COMPATIBILITY
KEYBOARD REQUIRED MORE TIME FOR ENTRY AND GAVE MORE ERRORS. THESE EXTRA
ERRORS WERE IDENTIFIED AS BEING PRIMARILY MEMORY RATHER THAN AIMING ERRORS.
THE RESULTS ARE DISCUSSED IN TERMS OF AN INTERFACE BETWEEN SHORT-TERM MEMORY
AND S-R COMPATIBILITY. THEY ARE HELD TO SUPPORT A MEMORY MODEL INVOLVING
A LIMITED-CAPACITY CHANNEL, AND A PRACTICAL DESIGN CONCLUSION IS SUGGESTED.

THE HIGH-COMPATIBILITY KEYBOARD USED IN THIS EXPERIMENT WAS THE STANDARD TOUCH-TONE TELEPHONE ARRANGEMENT. THE LOW-COMPATIBILITY KEYBOARD RANDOMLY ASSIGNED DIGITS TO A 3%3+1 FORMAT.

4P, 10R.

THE EXPERIMENT DESCRIBED IN THIS PAPER WAS WELL DONE AND IS CLEARLY REPORTED. ALTHOUGH THE RESULTS INDICATE THAT KEYBOARD ARRANGEMENT CAN AFFECT BOTH THE SPEED AND ERRORS OF DATA INPUT, THE EXPLANATION OFFERED FOR THIS FINDING IS INCONSISTENT WITH CURRENT PSYCHOLOGICAL THEORY. IN THE EXPERIMENTAL PARADIGM USED IN THIS STUDY, TWO TASKS WERE REQUIRED -- RECALLING DIGITS AND LOCATING THE APPROPRIATE KEYS. HUMANS HAVE A FINITE AMOUNT OF RESOURCES THAT CAN BE ALLOCATED TO SUCH TASKS. IT APPEARS THAT THE OBSERVED PERFORMANCE DIFFERENCES ARE DUE TO THE DIFFERENCES IN THE AMOUNT OF RESOURCES THAT MUST BE ALLOCATED TO THE KEY LOCATION TASK. THAT IS, THE LOW-COMPATABILITY KEYBOARD REQUIRES MORE RESOURCES TO BE ALLOCATED TO THE KEY LOCATION TASK AND THIS REDUCES THE RESOURCES THAT ARE AVAILABLE FOR THE DIGIT RECALL TASK. IN ADDITION, THE REHEARSAL OF A SINGLE DIGIT WHILE A SUBJECT SEARCHES FOR THE APPROPRIATE KEY INTERFERES WITH THE RETENTION OF OTHER DIGITS IN MEMORY. THIS SUGGESTS THE NEED TO EXAMINE EQUIPMENT IN TERMS OF THE RESOURCES REQUIRED FOR ITS OPERATION. THIS PAPER WOULD BE OF INTEREST TO THOSE CONCERNED WITH DATA ENTRY DEVICES AND ESPECIALLY TO THOSE CONCERNED WITH USING TOUCH-TONE TELEPHONES AS INPUT DEVICES.

108 COMPUTER AIDS FOR SONAR SIGNAL DETECTION
CORCORAN, D.W.J., DENNETT, J.L., & CARPENTER, A. THE COOPERATION OF MAN AND
COMPUTER IN CLASSIFICATION (REPORT ND. DES-522). LONDON, ENGLAND: ROYAL
NAVAL PERSONNEL RESEARCH COMMITTEE, OCTOBER 1970. (NTIS NO. AD 787024)
DESCRIPTION:

FIFTY-SIX SUBJECTS LISTENED TO SYNTHETIC PASSIVE SONAR SIGNALS MASKED BY CAVITATION NOISE. THEY HAD TO CLASSIFY EACH SIGNAL IN ONE OF 14 CATEGORIES. IN SOME SESSIONS, THEY WERE ABLE TO USE A VISUAL DISPLAY, WHICH INDICATED THE ORDER OF CHOICES MADE BY A COMPUTER. THE COMPUTER DISPLAY WAS OF VALUE, PARTICULARLY WHEN IT WAS RELIABLE, AND WHEN THE SIGNAL-TO-NOISE RATIO OF THE PASSIVE SONAR SIGNALS WAS LOW. THE SUBJECTS WERE ABLE TO COMBINE THE INFORMATION FROM THEIR EARS WITH THE VISUAL INFORMATION GIVEN BY THE COMPUTER. THERE WAS NO ADVANTAGE IN SPLITTING THE TASK BETWEEN TWO MEN: A MAN WHO SIMPLY LISTENED TO THE SONAR, AND A DECISION MAKER WHO COMBINED THE CHOICES OF THE MAN WITH THE CHOICES MADE BY THE COMPUTER. (A)

42P, 3R. COMMENTS:

NUMEROUS METHODOLOGICAL AND PROCEDURAL PROBLEMS MAKE IT DIFFICULT TO INTERPRET THE RESULTS AND IMPLICATIONS OF THIS RESEARCH. SINCE ONE GOAL OF THIS RESEARCH IS TO EVALUATE THE VALUE OF COMPUTER AIDS FOR EXPERIENCED SONAR OPERATORS, THE USE OF NAIVE SUBJECTS APPEARS INAPPROPRIATE. SINCE SUCH SUBJECTS ARE UNFAMILIAR WITH THE PROCESSING OF SONAR SIGNALS, IT IS VERY LIKELY THAT THEY WOULD RELY ON THE COMPUTER AIDS MORE HEAVILY THAN MORE EXPERIENCED SUBJECTS WOULD AND, THUS, THE MEASURED VALUE OF COMPUTER AIDS WOULD BE MUCH GREATER THAN IT WOULD BE IN AN ACTUAL OPERATIONAL SETTING. THERE IS ALSO A SUGGESTION OF FAIRLY LOW USER ACCEPTANCE, WHICH COULD BE A VERY SERIOUS PROBLEM FOR EXPERIENCED SONAR OPERATORS.

109 MANAGEMENT INFORMATION SYSTEMS

COUGER, J.D. SEVEN INHIBITORS TO A SUCCESSFUL MANAGEMENT INFORMATION SYSTEM. SYSTEMS AND PROCEDURES JOURNAL, JANUARY/FEBRUARY 1968, 19(1), 16-18. DESCRIPTION:

THE PROBLEMS IN THE LESS SUCCESSFUL FIRMS ARE COMMON TO BOTH LARGE AND SMALL CORPORATIONS. LACK OF EXPERIENCED DATA PROCESSING PERSONNEL WAS EVIDENCED TO A GREATER EXTENT IN THE MEDIUM-SIZED FIRMS. THE PRIMARY FACTORS INHIBITING THE DESIGN AND IMPLEMENTATION OF APPROPRIATE MANAGEMENT INFORMATION SYSTEMS FOR BOTH GROUPS OF FIRMS ARE EXPLAINED FULLY. (A) THESE FACTORS INCLUDE INCOMPLETE IDENTIFICATION OF INFORMATION NEEDS,

THESE PACTORS INCLUDE INCOMPLETE IDENTIFICATION OF INFORMATION NEEDS, LACK OF INTEGRATED DESIGNS, IMPROPER PRIORITIES, INADEQUATE FEASIBILITY STUDIES, A LACK OF POST-IMPLEMENTATION AUDITS, FAILURE TO INCLUDE EXTERNAL INFORMATION REQUIREMENTS, AND THE USE OF UNSOPHISTICATED SYSTEMS ANALYSIS AND DESIGN TECHNIQUES.

3P, DR.

THIS PAPER PRESENTS THE RESULTS OF A SURVEY ON THE CAUSES OF MANAGEMENT INFORMATION SYSTEM FAILURE. OTHER PAPERS IN THIS AREA GENERALLY FOCUS ON AN IMPROPER ANALYSIS OF USER REQUIREMENTS AS THE CHIEF CAUSE OF FAILURE (E.G., R.L. ACKOFF, 1976). THIS PAPER, HOWEVER, ATTEMPTS TO COVER USER REQUIREMENTS ANALYSIS, SYSTEM DESIGN, IMPLEMENTATION, AND TESTING. NONE OF THESE AREAS IS ADEQUATELY DISCUSSED. ALTHOUGH SOME PROBLEMS ARE DESCRIBED AND SOME SOLUTIONS PROPOSED, NEITHER THE SERIOUSNESS OF THESE PROBLEMS NOR THE FEASIBILITY OF THESE SOLUTIONS IS DEMONSTRATED. THE READER WISHING A MORE THOROUGH AND CURRENT OVERVIEW OF THE DESIGN OF MANAGEMENT INFORMATION SYSTEMS IS REFERRED TO K.D. EASON (1976). THIS PAPER DOES, HOWEVER, CONTAIN IDEAS THAT SUGGEST AREAS IN WHICH MORE RESEARCH IS NEEDED.

110 TERMINALS

CRAFT, P.C.R. SOME ASPECTS OF HUMAN FACTORS IN TERMINAL DESIGN. IN MAN-COMPUTER INTERACTION (PROCEEDINGS, CONFERENCE ON MAN-COMPUTER INTERACTION, 2-4 SEPTEMBER 1970) (CONFERENCE PUBLICATION NO. 68). LONDON, ENGLAND: INSTITUTION OF ELECTRICAL ENGINEERS, 1970, 77-82.

DESCRIPTION:

IN DESIGNING LARGE-SCALE ON-LINE COMPUTER SYSTEMS IT IS OFTEN DIFFICULT TO ENSURE THAT DUE ATTENTION IS PAID TO THE HUMAN FACTORS PROBLEMS THAT CAN ARISE IN THE DAY-TO-DAY OPERATION OF TERMINAL DEVICES. THE SUPPLY OF CODIFIED AND SYSTEMATICALLY ORGANIZED DATA LAGS WELL BEHIND THE DESIGNERS' NEEDS, AND AT PRESENT IT IS OFTEN NECESSARY TO CARRY DUT RAPID AD HOC HUMAN FACTOR DESIGN STUDIES, OR EVEN TO PROCEED ENTIRELY WITHOUT GUIDANCE FROM EXPERIENCE. (A)

GUIDANCE FROM EXPERIENCE. (A)

THIS PAPER DESCRIBES A REAL-TIME SYSTEM IMPLEMENTED BY BRITISH EUROPEAN
AIRWAYS AND DISCUSSES THE EXPERIENCES DERIVED FROM THIS EFFORT AND THE
IMPLICATIONS OF THIS KNOWLEDGE FOR FUTURE APPLICATIONS.
6P. OR.

COMMENTS:

THIS PAPER DESCRIBES THE AUTHOR'S EXPERIENCES THAT WERE GAINED IN THE OPERATION OF TERMINAL DEVICES ASSOCIATED WITH A LARGE-SCALE, REAL-TIME COMPUTER SYSTEM. THE AUTHOR'S DISCUSSION IS INFORMAL, UNSUPPORTED BY EMPIRICAL DATA, AND NOT VERY WELL DETAILED -- THIS IS A "MY IMPRESSIONS" KIND OF PAPER. NEVERTHELESS, SOME OF THE OBSERVATIONS ARE USEFUL AND MANY INDICATE AREAS IN WHICH CONTROLLED RESEARCH IS NEEDED. THE PAPER SHOULD BE OF INTEREST TO THOSE CONCERNED WITH TERMINAL DESIGN OR SELECTION.

111 HUMAN INFORMATION PROCESSING CAPABILITIES AND LIMITATIONS CRAWFORD, B.M., TOPMILLER, D.A., & KUCK, G.A. MAN-MACHINE DESIGN CONSIDERATIONS IN SATELLITE DATA MANAGEMENT (REPORT NO. AMRL-TR-77-13).

JRIGHT-PATTERSON AFB, OHIO: AIR FORCE SYSTEMS COMMAND, AEROSPACE MEDICAL RESEARCH LABORATORY, APRIL 1977. (NTIS NO. AD A041287)
DESCRIPTION:

THE REPORT IS DIVIDED INTO THREE SECTIONS: SECTION I IS AN INTRODUCTION TO HUMAN INFORMATION PROCESSING THEORY WITH IMPLICATIONS OF THE HUMAN INFORMATION PROCESSING CAPACITY AND LIMITAYIONS FOR THE SATELLITE DATA MANAGEMENT (SDM) "USER PIPE"; SECTION II INCORPORATES TWO SUBSECTIONS DEALING WITH MAN-COMPUTER RELATIONSHIPS AND COMPUTER DECISION AIDING TECHNIQUES; NO ATTEMPT IS MADE TO SPECIFY SPECIFIC DESIGN CONSIDERATIONS FOR SDM —- ONLY IMPLICATIONS CAN BE INFERRED; SECTION III IS AN ATTEMPT TO RELATE THE FIRST TWO GENERAL SECTIONS TO SOME OF THE ANTICIPATED CONCEPTUAL DESIGN ISSUES FOR SATELLITE DATA MANAGEMENT. (A) 25P, 7R.

COMMENTS:

THIS PAPER BEGINS WITH A BRIEF, BUT FAIRLY ACCURATE, DISCUSSION OF HUMAN INFORMATION PROCESSING THAT CENTERS AROUND SENSORY CHANNEL CAPACITY AND INFORMATION TRANSMISSION RATES. SEVERAL IMPLICATIONS, DERIVED FROM THIS FRAMEWORK, ARE ALSO PRESENTED. ALTHOUGH MANY OF THESE IMPLICATIONS HAVE BEEN DEMONSTRATED EMPIRICALLY, NO REFERENCES ARE CITED. IN DISCUSSING SATELLITE DATA MANAGEMENT, THE AUTHORS COMPARE DESIRED SYSTEM FUNCTIONS WITH MAN-MACHINE FUNCTIONS AND INDICATE THOSE AREAS WHERE THE RELEVANT STATE OF THE ART IN MAN-MACHINE TECHNOLOGY IS EITHER ADEQUATE OR INADEQUATE. ALTHOUGH EVIDENCE TO SUPPORT THESE CONCLUSIONS IS NOT PRESENTED, THEY SEEM, IN GENERAL, TO BE REASONABLE AND INDICATE AREAS WHERE ADDITIONAL ADVANCES ARE REQUIRED IN A WIDE RANGE OF MAN-COMPUTER TASKS.

112 DISPLAYS

CROPPER, A.G., & EVANS, S.J.W. ERGONOMICS AND COMPUTER DISPLAY DESIGN. THE COMPUTER BULLETIN, JULY 1968, 12(3), 94-98.
DESCRIPTION:

THE MAJOR ROLE OF THE ERGONOMIST CONCERNED WITH COMPUTERS INVOLVES
MATCHING THE OPERATING AND INPUT-OUTPUT CHARACTERISTICS OF THE COMPUTER WITH
THE CAPABILITYES OF THE USER

THE CAPABILITIES OF THE USER.

THIS WILL RANGE FROM FAIRLY STRAIGHTFORWARD QUESTIONS OF PHYSICAL
ABILITY, SUCH AS ENSURING THAT THE LOADING OF A LINE PRINTER OR DISC UNIT
DOES NOT DEMAND PHYSICAL EFFORT BEYOND THE ABILITY OF A GIRL OPERATOR, TO
COMPLEX PROBLEMS OF PSYCHOMOTOR SKILL, SUCH AS HOW ONE SHOULD CHOOSE BETWEEN
WARIOUS ALTERNATIVE DEVICES FOR GRAPHIC COMMUNICATION WIA A DISPLAY DEVICE.

VARIOUS ALTERNATIVE DEVICES FOR GRAPHIC COMMUNICATION VIA A DISPLAY DEVICE.
WHATEVER THE PROBLEM, THE ERGONOMIST WILL ENDEAVOUR TO BRIDGE THE GAP
BETWEEN MAN AND EQUIPMENT WITH HIS KNOWLEDGE ABOUT HUMAN BEHAVIOUR AND
PERFORMANCE.

THE REMAINDER OF THIS PAPER WILL EXAMINE HOW THIS PRINCIPLE CAN BE PUT INTO PRACTICE IN ONE COMPUTER AREA WHERE EFFECTIVE MAN-MACHINE COMMUNICATION IS PARTICULARLY IMPORTANT, THAT OF COMPUTER VISUAL DISPLAYS. (A, ABBR.) 5P. 16R.

SP, 16 COMMENTS:

THIS PAPER PRESENTS A CONCISE, EASY TO READ DISCUSSION OF DISPLAY PARAMETERS. WHERE ESTABLISHED, DESIRED VALUES OF THESE PARAMETERS ARE PRESENTED. ALTHOUGH THIS PAPER IS SOMEWHAT DATED, MUCH OF THE PRESENTED INFORMATION IS STILL RELEVANT AND PROVIDES A GOOD INTRODUCTION TO HUMAN FACTORS ISSUES IN DISPLAY DESIGN.

PAPER SIMULATION

CROSS, N. SIMULATION OF COMPUTER-AIDED DESIGN. IN PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON MAN-MACHINE SYSTEMS, 8-12 SEPTEMBER 1969 (VOL. 1) (IEEE CONFERENCE RECORD NO. 69C58-MMS). NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., 1969. DESCRIPTION:

THIS PAPER DESCRIBES A RESEARCH PROJECT WHICH WAS AIMED AT ESTABLISHING A

THIS PAPER DESCRIBES A RESEARCH PROJECT WHICH WAS AIMED AT ESTABLISHING A METHOD FOR THE INVESTIGATION OF MAN-MACHINE INTERACTION IN COMPUTER-AIDED DESIGN, THROUGH SIMULATION. SUCH A METHOD WOULD PERMIT THE SYSTEMIC BEHAVIOR PATTERNS TO BE PREDICTED IN ADVANCE, AS A GUIDE FOR DEVELOPMENT. THE PROJECT WAS CONCERNED PRIMARILY WITH COMPUTER-AIDED DESIGN SYSTEMS IN ARCHITECTURE, AND IT WAS PROPOSED THAT THE COMPUTER PART OF THESE SYSTEMS COULD BE SIMULATED BY A TEAM OF EXPERT SPECIALISTS. IT WAS THE MAIN OBJECTIVE OF THE PROJECT TO ESTABLISH THE FEASIBLITY OF SUCH A SIMULATION, BY CONDUCTING EXPERIMENTS CONSISTING OF DESIGN EXERCISES IN WHICH THE DESIGNED HAS ACCESS THROUGH SOME COMMUNICATION MEDIUM TO A HUMAN "FXPERT DESIGNER HAS ACCESS THROUGH SOME COMMUNICATION MEDIUM TO A HUMAN "EXPERT COMPUTER."

THE TECHNIQUE OF SIMULATION WAS DEVELOPED OVER A SERIES OF EXPERIMENTS, AND IN ITS FINAL FORM PROVIDED COMMUNICATION BETWEEN DESIGNER AND "COMPUTER" BY MEANS OF WRITTEN MESSAGES TRANSMITTED OVER A CLOSED CIRCUIT TELEVISION LINK.

IT WAS CONCLUDED FROM THE PROJECT THAT SIMULATION OF COMPUTER-AIDED DESIGN SYSTEMS USING A TEAM OF EXPERTS AS THE "COMPUTER" IS FEASIBLE AND COULD USEFULLY BE ADOPTED AS A RESEARCH TECHNIQUE BY THOSE NOW ENGAGED IN ESTABLISHING COMPUTER-AIDED DESIGN SYSTEMS. SOME OBSERVATIONS WERE ALSO MADE FROM THE EXPERIMENTS OF THE MOST EVIDENT FEATURES OF THE PATTERNS OF MAN-MACHINE INTERACTIONS. IT WAS ALSO POSSIBLE TO SPECULATE FROM THE EXPERIMENTS ON THE NATURE OF THE MAN AND MACHINE ROLES WHICH SHOULD BE MOST PROFITABLE IN COMPUTER-AIDED DESIGNING, WITH THE CONCLUSION THAT WE SHOULD ACCEPT CONCEPTS OF AUTOMATION, RATHER THAN MECHANIZATION. (A)

6P, OR.

ALTHOUGH THIS PAPER DOES NOT DESCRIBE THE RESULTS OF THE SIMULATION EFFORT IN MUCH DETAIL, IT DOES MENTION SEVERAL EXAMPLES OF THE KIND OF INSIGHTS WHICH CAN BE GAINED THROUGH THE USE OF "PAPER SIMULATION." FOR EXAMPLE, THE USERS FOUND USE OF THE SIMULATED ARCHITECTURAL DESIGN SYSTEM RATHER STRESSFUL UNTIL THE COMPUTER WAS ASSIGNED A MORE ACTIVE ROLE IN THE DESIGN EFFORT. THEN USE OF THE SYSTEM WAS MORE COMFORTABLE AND SATISFYING. THOSE CONCERNED WITH USER REQUIREMENTS DEFINITION FOR INTERACTIVE SYSTEMS MAY FIND THIS PAPER OF INTEREST.

114 PROBLEM SOLVING AID

CUSHMAN, R.H. TOFT: A METHOD FOR ELECTRONIC DOODLING AND A FIRST STEP TOWARDS THE USE OF COMPUTERS ON ILL-DEFINED PROBLEMS. IN PROCEEDINGS OF THE 1972 INTERNATIONAL CONFERENCE ON CYBERNETICS AND SOCIETY. NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTROHICS ENGINEERS, INC., 1972, 157-162. DESCRIPTION:

A THINKING PROCEDURE IS DESCRIBED. IT TAKES MANY OF THE ESTABLISHED THINKING AND LEARNING PROCEDURES KNOWN TO BE OF USE IN PROBLEM SOLVING AND TIES THEM TO SEQUENTIAL STEPS IN WHICH THE HUMAN THINKER WORKS WITH A DYNAMIC ELECTRONIC SKETCH PAD.

IT IS CLAIMED THAT THIS METHOD ALLOWS MAN TO APPLY SOME OF THE SYSTEMS MODELLING CONCEPTS THAT HAVE BEEN USED SO SUCCESSFULLY IN SOLVING THE WELL-DEFINED PROBLEMS OF THE ENGINEERING WORLD TO THOSE MUCH MORE IMPORTANT PROBLEMS OF MAN'S PERSONAL SUBJECTIVE BEHAVIORAL WORLD.

IT IS ALSO CLAIMED THAT THIS METHOD WILL PERMIT MAN TO USE HIS MENTAL

IT IS ALSO CLAIMED THAT THIS METHOD WILL PERMIT MAN TO USE HIS MENTAL ABILITIES IN A MORE EFFICIENT MANNER. THIS IS BECAUSE IN THIS METHOD THE PROBLEM SOLVER PLAYS BOTH TEACHER AND STUDENT WITH HIMSELF THAT STIMULATES HIM TO INCREASED INSIGHT INTO PROBLEMS AND THENCE TO SPAWNING CREATIVE SOLUTIONS.

IT IS ALSO CLAIMED THAT THIS METHOD IS A NATURAL WAY OF TRANSFORMING ILL-DEFINED PROBLEMS INTO MACHINE LANGUAGE, READY FOR MECHANIZED OLUTION BY COMPUTERS. (A)

COMMENTS:

THIS IS AN INTERESTING, EASY TO READ PAPER. THE AUTHOR BEGINS WITH THE OBSERVATION THAT MANY OF THE PROBLEMS THAT WE CONFRONT ARE ILL-DEFINED AND THAT PROGRESS IN DEVELOPING MAN-COMPUTER PROBLEM-SOLVING SYSTEMS IS SEVERELY LIMITED BY MAN'S ABILITY TO TRANSLATE THESE ILL-DEFINED PROBLEMS INTO THE WELL-DEFINED FORMULATION REQUIRED BY THE COMPUTER. THE ADMITTEDLY PRIMITIVE SYSTEM DESCRIBED HERE MIGHT VERY WELL AID IN THIS TRANSLATION AND, IN ADDITION, IT INCORPORATES SEVERAL USEFUL PROBLEM-SOLVING AIDS. ALTHOUGH THE SYSTEM DESCRIBED IS DESIGNED FOR USE IN ELECTRONIC CIRCUIT DESIGN, MANY OF THE SYSTEM'S FEATURES COULD BE ADAPTED FOR USE IN OTHER APPLICATION AREAS.

115 USER NEEDS WITH RESPECT TO SYSTEM SUPPORT FUNCTIONS
DAMODARAN, L. THE ROLE OF USER SUPPORT: ACTUAL AND POTENTIAL. PAPER
PRESENTED AT NATO ADVANCED STUDY INSTITUTE ON MAN-COMPUTER INTERACTION,
MATI, GREECE, SEPTEMBER 1976.
DESCRIPTION:

MAN-COMPUTER INTERACTION TRANSFORMS THE POTENTIAL POWER OF A COMPUTER SYSTEM INTO REALITY. THE FIRST ESSENTIAL CONDITION FOR INTERACTION IS A PHYSICAL MEANS FOR ACHIEVING COMMUNICATION BETWEEN THE COMPUTER AND THE MAN, USING THE HARDWARE OF THE FORMER (COMPUTER TERMINALS, DATA PREPARATION FORMS, PRINT-OUT, ETC.) AND THE SENSE MODALITIES OF THE LATTER. THE NEXT REQUIREMENT IS A SHARED, SYMBOLIC CODING SYSTEM WHICH ALLOWS THE MEANING OF THE COMMUNICATION TO BE UNDERSTOOD BY MAN AND BY COMPUTER. BOTH THESE PRE-REQUISITES FOR INTERACTION THEN REQUIRE ACTIVE SUPPORT OF A HUMAN USER TO ACHIEVE THE TRANSFORMATION INTO A VIABLE SYSTEM. THE PRIMARY FOCUS OF THIS PAPER IS THE SUPPORT GIVEN BOTH BY THE USER AND TO THE USER IN THE INTERACTION PROCESS. THE CONTENTS OF THE PAPER ARE BASED MAINLY UPON FINDINGS OF THE "MICA" SURVEY (EASON, K.D., DAMODARAN, L., AND STEWART, T.F.M., 1974) OF OVER 250 PEOPLE WHO ARE NOT COMPUTER PROFESSIONALS BUT WHO MAKE USE OF COMPUTER SYSTEMS IN THEIR WORK ROLES. IT IS IMPORTANT TO NOTE THAT PRIOR TO THE SURVEY THE ROLE OF USER SUPPORT AS A SIGNIFICANT VARIABLE IN DETERMINING THE EFFECTIVENESS OF MAN-COMPUTER INTERACTION HAD NOT BEEN RECOGNIZED. FOR THAT REASON IT WAS EXAMINED IN A SYSTEMATIC WAY USING STRUCTURED QUESTIONS. IN CONSEQUENCE THE FINDINGS DISCUSSED HERE ARE OF A MAINLY QUALITATIVE NATURE AND SHOULD BE REGARDED AS A BASIS FOR QUANTIFICATION IN FUTURE INVESTIGATIONS. (A)

COMMENTS:

THE AUTHOR OF THIS PAPER CONTENDS THAT MAN-COMPUTER INTERACTION OFFERS A POTENTIAL POWER TO USERS THAT IS NOT ADEQUATELY UTILIZED. THE PRIMARY REASON FOR THIS IS INADEQUATE USER SUPPORT. USER SUPPORT SHOULD NOT ONLY TEACH A USER HOW TO USE THE SYSTEM (COMPENSATORY SUPPORT), BUT SHOULD ALSO HELP THE USER TO EVOLVE WITH THE SYSTEM AND TO DEVELOP A FORM OF INTERACTION TO SUIT HIS NEEDS (EVOLUTIONARY SUPPORT). EVOLUTIONARY USER SUPPORT COULD BE PROVIDED BY DEDICATED PROGRAMMERS AND LOCAL SYSTEM EXPERTS. VARIOUS SOCIAL AND ECONOMIC PRESSURES, HOWEVER, MAY KEEP SUCH PERSONNEL FROM FUNCTIONING EFFECTIVELY IN THIS ROLE. CRITERIA FOR EFFECTIVE USER SUPPORT ARE PROPOSED.

116 GUIDELINES FOR DISPLAY FORMATTING
DANCHAK, M.M. CRT DISPLAYS FOR POWER PLANTS. INSTRUMENTATION TECHNOLOGY,
OCTOBER 1976, 23(10), 29-36.
DESCRIPTION:

THIS PAPER IS INTENDED TO ASSIST THE CRT DISPLAY DESIGNER WHO IS NOT A HUMAN FACTORS SPECIALIST. WHILE SOME OF THE DISCUSSION IS SPECIFIC TO POWER PLANT DISPLAYS, MOST IS GENERALLY APPLICABLE. THE AUTHOR DISCUSSES THE RELATIONSHIP OF OPERATOR PERFORMANCE TO VARIOUS DISPLAY PROPERTIES. RECOMMENDATIONS ARE MADE WITH RESPECT TO SELECTION OF A BASIC MODE OF PRESENTATION (AS A FUNCTION OF GENERAL OPERATOR TASK), SELECTION OF DISPLAY CODING METHODS (AS A FUNCTION OF SPECIFIC OPERATOR TASK), COLOR USE (SPECIFIC TO POWER PLANT DISPLAYS), AND VARIOUS OTHER FACTORS SUCH AS DISPLAY DENSITY, WORD SIZE, SPACING AND ORIENTATION, AND CHOICE OF QUADRANT FOR PLACEMENT OF INFORMATION ON THE SCREEN.

COMMENTS:

THIS IS A BASICALLY USEFUL ATTEMPT TO DIGEST A NUMBER OF HUMAN FACTORS RESEARCH FINDINGS AND CONVERT THEM INTO THE FORM OF RECOMMENDATIONS FOR USE BY A DISPLAY DESIGNER WHO IS NOT A HUMAN FACTORS SPECIALIST. IT HAS THE ADVANTAGE OF BEING QUITE READABLE AND GENERALLY PRESENTABLE, IN PART BECAUSE OF THE USE OF SEVERAL NICE COLOR PHOTOGRAPHS. FURTHERMORE, MOST OF THE ADVICE GIVEN IS QUITE GOOD, AND THE PAPER SERVES TO FOCUS THE READER'S ATTENTION ON THE RELEVANT GENERAL ISSUES IN DISPLAY DESIGN. UNFORTUNATELY, SOME OF THE RECOMMENDATIONS ARE ALSO QUESTIONABLE. FOR EXAMPLE, THE AUTHOR RECOMMENDS ABBREVIATING WORDS, AT SOME COST IN READABILITY, IN AN ATTEMPT TO FIT THEM WITHIN AN AREA CORRESPONDING TO THE FOVEA CENTRALIS, SO THAT THEY CAN BE READ WITH A SINGLE RAPID VISUAL FIXATION. WHILE THIS MAY BE REASONABLE IN CERTAIN SITUATIONS, THERE ARE PROBABLY FAR MORE SITUATIONS IN WHICH THE NET EFFECT OF THIS PRACTICE IS NEGATIVE. IN PART, OF COURSE, THIS DEPENDS ON USER TRAINING AND EXPERIENCE, AS WELL AS THE FREQUENCY OF APPEARANCE OF SPECIFIC ABBREVIATIONS, THEIR NUMBER, ETC. IT IS DOUBTFUL, THOUGH, THAT THIS OVERSIMPLIFICATION IS A SERVICE TO THE READER. THE AUTHOR ALSO RECOMMENDS THAT IMPORTANT INFORMATION BE PLACED IN PARTICULAR AREAS OF THE DISPLAY ON THE BASIS OF TARGET DETECTION STUDIES IN WHICH THE SUBJECT HAD NO STANDARD FORMAT OR SYSTEM EXPERIENCE ON WHICH TO BASE AN OPTIMAL VISUAL STANCER STRATEGY. IT IS, OF COURSE, IMPOSSIBLE TO DEVELOP SIMPLE GUIDELINES WHICH SATISFY ALL SITUATIONS AND ALL USERS, BUT OVERSIMPLIFICATION SEEMS TO HAVE HAD A DETRIMENTAL EFFECT HERE. NONETHELESS, IF READ CAUTIOUSLY, THIS PAPER IS A REASONABLY GOOD INTRODUCTION TO SOME GENERAL HUMAN FACTORS CONSIDERATIONS IN DISPLAY DESIGN.

117 DECISION AIDING BY CAPTURING DECISION MAKER UTILITIES
DAVIS, K.B., WEISBROD, R.L., FREEDY, A., & WELTMAN, G. ADAPTIVE COMPUTER
AIDING IN DYNAMIC DECISION PROCESSES: AN EXPERIMENTAL STUDY OF AIDING
EFFECTIVENESS (TECHNICAL REPORT PTR-1016-75-50). WOODLAND HILLS, CALIFORNIA:
PERCEPTRONICS, INC., MAY 1975. (NTIS NO. AD AD14218)
DESCRIPTION:

THIS REPORT DESCRIBES AN EXPERIMENTAL STUDY WHICH WAS PERFORMED TO EVALUATE (1) THE EFFECTIVENESS OF ADAPTIVE DECISION AIDING FOR IMPROVING DECISION MAKER (DM) PERFORMANCE AND (2) THE CONSISTENCY OF DECISION BEHAVIOR IN A SITUATION IN WHICH THE DM CAN DEVELOP A VIABLE STRATEGY. TWELVE NAVAL RESERVE NON-COMMISSIONED OFFICERS, DIVIDED INTO AN EXPERIMENTAL AND A CONTROL GROUP, GATHERED INTELLIGENCE ABOUT A SIMULATED FISHING FLEET MOVING ABOUT AN EXPANSE OF OCEAN AND REPORTED ITS STATUS, BY ALLOCATING A VARIETY OF SENSORS WITH VARYING PROPERTIES AND COSTS. AFTER TRAINING, SUBJECTS IN THE EXPERIMENTAL GROUP RECEIVED DECISION AIDING FROM THE ADDAM (ADAPTIVE DYNAMIC DECISION AIDING MECHANISM) SYSTEM, WHICH OPERATES BY ADAPTIVELY TRACKING THE OPERATOR'S DECISIONS AND ESTIMATING HIS UTILITY FUNCTIONS, WHILE CONTROL SUBJECTS CONTINUED THE TASK WITHOUT AIDING. AIDED SUBJECTS PERFORMED MORE CONSISTENTLY AND BETTER. THE REPORT DISCUSSES DECISION AIDING IN GENERAL AND 44P, 17R.

COMMENTS:

IN THIS DECISION AIDING TECHNIQUE, THE SYSTEM OBSERVES THE DECISION BEHAVIOR OF THE DECISION MAKER AND DERIVES A SET OF ESTIMATED UTILITIES FOR VARIOUS ALTERNATIVE ACTIONS AVAILABLE TO HIM. THESE UTILITIES ARE DYNAMICALLY MAINTAINED, AND THEREFORE CHANGE OVER TIME TO CORRESPOND TO THE DECISION MAKER'S BEHAVIOR. THE SYSTEM USES THESE UTILITIES, IN THE AIDING MODE, TO INDICATE, TO THE DECISION MAKER, THE APPARENT OPTIMAL DECISION AT EACH NEW DECISION POINT, BASED ON THE STRATEGY (I.E., THE UTILITIES) WHICH HE APPEARS TO BE EMPLOYING. BASICALLY, AIDS OF THIS SORT OPERATE BY HELPING THE DECISION MAKER TO APPLY HIS OWN DECISION STRATEGY IN A MORE CONSISTENT MANNER THAN HE WOULD IF UNAIDED. THE EXPERIMENT REPORTED HERE SUGGESTS THAT THIS AIDING MECHANISM IMPROVES PERFORMANCE ON A SIMULATED INTELLIGENCE—GATHERING TASK, THAT IT REDUCES PERFORMANCE VARIABILITY, AND THAT THE AID IS READILY ACCEPTED BY THE DECISION MAKERS. THIS APPEARS TO BE A WELL CONDUCTED EXPERIMENT, AND THE RESULTS ARE CONSISTENT WITH OTHER SIMILAR STUDIES. FOR SUCH AIDS TO BE USEFUL WITH "REAL-WORLD" PROBLEM-SOLVING TASKS, THE TASKS MUST BE WELL STRUCTURED AND REASONABLY CONSISTENT OVER TIME. THE BEHAVIOR OF THE INDIVIDUAL DECISION MAKER MUST ALSO BE OBSERVED FOR SOME TIME AS HE ENGAGES IN THE SOLUTION OF SUCH PROBLEMS. TASKS SUCH AS THE SENSOR DEPLOYMENT TASK SIMULATED HERE MAY SATISFY THESE CRITERIA, BUT MANY TACTICAL AND STRATEGIC DECISION TASKS PROBABLY DO NOT. IT IS, THEREFORE, IMPORTANT TO SELECT CAREFULLY THE TASKS FOR WHICH SUCH DECISION ALDS ARE USED. THIS PAPER IS SHORT AND FAIRLY READABLE, AND SHOULD INTEREST THOSE CONCERNED WITH DECISION AIDING.

118 MAN-COMPUTER INTERACTION, REVIEW

DAVIS, R.M. MAN-MACHINE COMMUNICATION. IN C.A. CUADRA (ED.), ANNUAL REVIEW OF INFORMATION SCIENCE AND TECHNOLOGY (VOL. 1). NEW YORK: WILEY, 1966, 221-254. DESCRIPTION:

THIS PAPER REVIEWS THE 1965 (AND SOME EARLIER) LITERATURE CONCERNED WITH MAN-COMPUTER INTERACTION. THE PRINCIPAL TOPICS CONSIDERED ARE TIME-SHARING AND MAN-MACHINE INTERACTIVE LANGUAGES. REVIEWS ARE ALSO PRESENTED FOR THE AREAS OF ON-LINE MAN-MACHINE APPLICATIONS, MAN-MACHINE INTERACTIVE DISPLAYS, PROBLEM SOLVING, AND APPLICATIONS OF MAN-MACHINE COMMUNICATION TO SPECIFIC USER GROUPS.

34P, 99R. COMMENTS:

THIS IS A GOOD, HIGH-LEVEL REVIEW OF THE FIELD OF MAN-COMPUTER INTERACTION FROM A COMPUTER SCIENCE PERSPECTIVE. NATURALLY, IT IS SOMEWHAT DATED NOW. HOWEVER, IT REMAINS AN EXCELLENT SDURCE OF HISTORICAL PERSPECTIVE. IT IS PROBABLY THE EARLIEST SIGNIFICANT REVIEW OF THE FIELD, AND IT IS INTERESTING TO COMPARE AND CONTRAST ITS CONCERNS WITH THOSE WHICH DOMINATE THE LITERATURE TODAY. IT IS NOT, HOWEVER, A TECHNICALLY DETAILED PAPER, AND THERE ARE FEW SPECIFIC CONCLUSIONS WHICH CAN BE DRAWN FROM IT. IT IS THEREFORE A GOOD PAPER FOR THOSE WITH A GENERAL, HISTORICAL INTEREST IN THE FIELD, BUT AN INAPPROPRIATE PAPER FOR THOSE SEEKING TECHNICAL GUIDELINES.

119 USES OF INTERACTIVE GRAPHICS

DAY, C.W., & ZIMMERMAN, L.L. IMPLEMENTATION AND USAGE. IBM SYSTEMS JOURNAL, 1968, 7, 373-381.

DESCRIPTION:

THE PRESENT STATUS OF INTERACTIVE DISPLAYS IN THE APPLICATION ENVIRONMENT IS REVIEWED.

ALTHOUGH GRAPHICS DATA PROCESSING IS STILL LARGELY EXPERIMENTAL, SEVERAL APPLICATIONS HAVE COME INTO PRODUCTIVE USE -- ESPECIALLY IN THE AREAS OF DATA AND DESIGN ANALYSIS. THE PRIMARY BENEFIT FROM ENHANCING SUCH APPLICATIONS WITH GRAPHIC DISPLAYS IS THE SAVINGS IN CALENDAR TIME.

BEFORE SURVEYING SEVERAL APPLICATION AREAS, USER ASPECTS AND APPLICATION CHARACTERISTICS ARE DISCUSSED. (A)

9P, 2R. COMMENTS:

THE PRIMARY FOCUS OF THIS PAPER IS ON THE TYPE OF APPLICATIONS IN WHICH INTERACTIVE GRAPHICS CAN FACILITATE MAN-MACHINE INTERACTION. AN INTERACTIVE GRAPHICS TERMINAL CAN BE A USEFUL PROBLEM SOLVING AID, SINCE SUCH A TERMINAL CAN BE USED TO PRESENT RESULTS IN A MANNER THAT CAN BE QUICKLY UNDERSTOOD BY THE ANALYST. THIS IS ESPECIALLY IMPORTANT IN TASKS THAT INVOLVE SPATIAL RELATIONS (E.G., CIRCUIT DESIGN) OR RAPIDLY CHANGING VARIABLES (E.G., TRAJECTORY AMALYSIS). THIS PAPER DOES NOT CONSIDER IN ANY DETAIL THE HUMAN FACTORS ASPECTS OF INTERACTIVE GRAPHIC TERMINALS OR THE EQUALLY IMPORTANT QUESTION OF WHAT TYPE OF TASK IS BEST FACILITATED BY AN INTERACTIVE GRAPHICS TERMINAL, AS OPPOSED TO SOME OTHER FORM OF INTERACTIVE TERMINAL OR OTHER TYPES OF DEVICES. THIS PAPER MAY BE RELEVANT TO THOSE INTERESTED IN A BRIEF REVIEW OF HOW INTERACTIVE GRAPHICS TERMINALS ARE BEING USED.

120 ORGANIZATIONAL IMPLICATIONS OF COMPUTERS
DE BRABANDER, B., VANLOMMEL, E., DESCHOOLMEESTER, D., & LEYDER, R. THE
IMPACT OF COMPUTER-USE ON ORGANIZATION STRUCTURE. PAPER PRESENTED AT NATO
ADVANCED STUDY INSTITUTE ON MAN-COMPUTER INTERACTION, MATI, GREECE,
SEPTEMBER 1976.

DESCRIPTION:

IN RECENT YEARS, A GREAT DEAL OF ATTENTION HAS BEEN DIRECTED AT DETERMINING THE IMPACT OF COMPUTER USE ON THE FUNCTIONING AND STRUCTURE OF LARGE ORGANIZATIONS. FOR THE MOST PART, HOWEVER, THE AVAILABLE LITERATURE IN THIS AREA IS DISAPPOINTING. MUCH OF THE WORK IN THIS AREA IS HIGHLY SPECULATIVE, IS BASED ON UNSYSTEMATIC AND SUBJECTIVE OBSERVATIONS, AND HAS NOT BEEN INTEGRATED INTO A COHERENT THEORETICAL FRAMEWORK. IN ADDITION, VERY LITTLE CONSIDERATION HAS BEEN GIVEN TO THE CONSEQUENCES OF THE ALTERED TASK ENVIRONMENT OF PERSONNEL WHICH IS DUE TO COMPUTER USE.

THIS PAPER REPORTS THE RESULTS OF AN EMPIRICAL INVESTIGATION OF SOME MANAGERIAL AND ORGANIZATIONAL CONSEQUENCES OF COMPUTER USE. THIS INVESTIGATION DIFFERS FROM PREVIOUS STUDIES IN THAT IT IS BASED ON A CONCEPTUAL FRAMEWORK WHICH FOCUSES ON THE INTER-CONNECTEDNESS OF CHANGES IN DIFFERENT CHARACTERISTICS AND IT CONCENTRATES ON CHANGES IN HUMAN TASK ENVIRONMENTS. THE PRINCIPAL RESULT OF THIS STUDY APPEARS TO BE THAT COMPUTER USE DOES NOT APPRECIABLY AFFECT THE SIZE, TASK COMPLEXITY, OR TECHNOLOGY OF LARGE ORGANIZATIONS.

40P, 25R. COMMENTS:

THIS PAPER BEGINS WITH A SHORT, BUT FAIRLY COMPREHENSIVE, REVIEW OF THE LITERATURE ON THE EFFECTS OF COMPUTER USE ON ORGANIZATIONAL STRUCTURE. BASED ON THIS LITERATURE REVIEW, THE AUTHORS ARE QUITE CORRECT IN ASSUMING THAT EXISTING STUDIES OF THE EFFECTS OF COMPUTER USE ON ORGANIZATIONAL STRUCTURE ARE INADEQUATE. IN THIS PAPER, A CONCEPTUAL FRAMEWORK IS DEVELOPED AND USED TO GENERATE PROBABLE CONSEQUENCES OF COMPUTER USE. THE REPORTED STUDY, HOWEVER, NEITHER CONFIRMS NOR REJECTS THESE PROBABLE CONSEQUENCES. THE FACT THAT COMPUTER USE DOES NOT AFFECT ORGANIZATIONAL STRUCTURE DOES NOT IMPLY THAT IT SHOULD NOT AFFECT THIS STRUCTURE. FOR EXAMPLE, L. DAMODARAN (1976) STRESSES THE NEED TO INVOLVE USER SUPPORT PERSONNEL IN INTERACTIVE SYSTEMS. ADDITIONAL RESEARCH ON THE QUESTION OF HOW COMPUTER USE AFFECTS ORGANIZATIONAL STRUCTURE IS NEEDED. A PREQUISITE FOR THIS RESEARCH, HOWEVER, APPEARS TO BE THE IDENTIFICATION OF THE APPROPRIATE DEPENDENT VARIABLES.

121 BIBLIOGRAPHY ON MAN-MACHINE INTERACTION
DEFENSE DOCUMENTATION CENTER. MAN-MACHINE INTERACTION: A DDC BIBLIOGRAPHY
(DOCUMENT NO. DDC-TAS-72-71). ALEXANDRIA, VIRGINIA: DEFENSE DOCUMENTATION
CENTER, NOVEMBER 1972. (NTIS NO. AD 752800)
DESCRIPTION:

THIS GENERAL BIBLIOGRAPHY ON MAN-MACHINE INTERACTION CONTAINS ABSTRACTS OF 192 DOCUMENTS FROM THE PERIOD 1953 TO 1972. 244P, 192R.

COMMENTS:

QUITE A FEW OF THE CITATIONS IN THIS BIBLIOGRAPHY CONCERN MAN-COMPUTER INTERACTION. THE MOST RELEVANT HAVE BEEN INCLUDED IN THE BIBLIOGRAPHY YOU ARE NOW READING, BUT SOME CITATIONS WHICH ARE OF MORE SPECIALIZED INTEREST, OR ARE LESS CLOSELY RELATED, MAY BE FOUND IN THIS DOC DOCUMENT. IT INCLUDES INDEXES BY CORPORATE AUTHOR, MONITORING AGENCY, AND SUBJECT, AND CONTAINS SOME CONTRACT INFORMATION FOR EACH CITATION.

122 COMPUTER APPLICATIONS IN HUMAN FACTORS, BIBLIOGRAPHY
DEFENSE DOCUMENTATION CENTER. USE OF COMPUTERS IN HUMAN FACTORS ENGINEERING:
A DCC BIBLIOGRAPHY (DOCUMENT NO. DDC-TAS-74-34). ALEXANDRIA, VIRGINIA:
DEFENSE DOCUMENTATION CENTER, NOVEMBER 1974. (NYIS NO. AD A001400)
DESCRIPTION:

THIS BIBLIOGRAPHY CONTAINS ABSTRACTS OF 178 DOCUMENTS FROM THE PERIOD 1953 TO 1974. ALTHOUGH THE TITLE SUGGESTS THAT THE TOPIC COVEMED IS THE APPLICATION OF COMPUTERS TO HUMAN FACTORS, MANY OF THE PAPERS ACTUALLY CONCERN HUMAN FACTORS AS APPLIED TO COMPUTER SYSTEMS. CORPORATE AUTHOR, MONITORING AGENCY, AND SUBJECT INDEXES ARE INCLUDED. 178P, 178R.

COMMENTS:

ONE OF THE PROBLEMS WITH SIMPLE KEYWORD SEARCH IS THAT IT IS IMPOSSIBLE TO SPECIFY A PARTICULAR RELATIONSHIP BETWEEN KEYWORDS (I.E., X AS APPLIED TO Y). SOME OF THE DOCUMENTS CONTAINED HERE ARE IN FACT PERTINENT TO THE PRESENT BIBLIOGRAPHY. IN PARTICULAR, THIS BIBLIOGRAPHY MIGHT BE USEFUL TO ONE INTERESTED SPECIFICALLY IN DEPARTMENT OF DEFENSE WORK.

123 REVIEW OF HUMAN FACTORS IN COMPUTER SYSTEMS
DEGREENE, K.B. MAN-COMPUTER INTERRELATIONSHIPS. IN K.B. DEGREENE (ED.),
SYSTEMS PSYCHOLOGY. NEW YORK: MCGRAW-HILL, 1970, 281-336.
DESCRIPTION:

THIS CHAPTER FIRST REVIEWS HISTORY AND TRENDS TOWARD GREATER COMPUTER SYSTEMATIZATION. AREAS OF SPATIAL AND TEMPORAL INTERFACE BETWEEN MAN AND COMPUTER RECEIVE SPECIAL ATTENTION. WE THEN CONSIDER IMPORTANT SPECIALIZED AREAS OF RESEARCH AND APPLICATIONS WHICH INCLUDE MEANS OF DIRECT, USUALLY DYNAMIC MAN-COMPUTER COMMUNICATION BY INPUT AND DISPLAY DEVICES IN TERMS OF GIVEN LANGUAGE STRUCTURES, TIME SHARING, AND "SYMBIOTIC" PROBLEM SOLVING. HUMAN FACTORS AND MANAGERIAL CONSIDERATIONS IN COMPUTER SYSTEMS FOLLOW. THE CHAPTER ENDS WITH AN EVALUATION OF THE CONTINUED SOCIETAL IMPACT OF COMPUTERS. (A) 56P, 65R.

COMMENTS:

THIS IS AN EXCELLENT INTRODUCTION TO THE FIELD OF HUMAN FACTORS IN COMPUTER SYSTEMS FOR THE PSYCHOLOGIST OR HUMAN FACTORS SPECIALIST WITH A LIMITED BACKGROUND IN COMPUTER SYSTEMS. THE CHAPTER IS LESS USEFUL FOR THE COMPUTER SCIENTIST, AS IT ASSUMES A KNOWLEDGE OF HUMAN ENGINEERING AND DEVOTES MOST OF ITS CONCERN TO ACQUAINTING THE READER WITH COMPUTER SYSTEMS AS AN APPLICATION AREA. AS A REVIEW OF THE LITERATURE, IT IS BROAD BUT NOT VERY COMPREHENSIVE OR DETAILED.

A CRITICALLY ANNOTATED BIBLIOGRAPHY OF THE LITERATURE ON HUMAN --ETC(U)
MAY 78 H R RAMSEY, M E ATWOOD, P J KIRSHBAUM N00014-76-C-0866
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124 INTERACTIVE GRAPHICS

DELOTTO, I. PROBLEMS ASSOCIATED WITH THE GRAPHIC INTERACTION OF OPERATOR-COMPUTER (TRANSLATION OF CENTRO INFORMAZIONI STUDI ESPERIENZA, MILAN, REPORT CISE-115) (REPORT NO. NASA-TT-F-13816). WASHINGTON, D.C.: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, NOVEMBER 1970. (NTIS NO. N71-31081) DESCRIPTION:

THE PURPOSE OF THIS PAPER IS TO DISCUSS THE PRINCIPAL PROBLEMS CONFRONTED IN THE HEART OF THE PROGNAM "COLD" FOR THE REALIZATION AND THE EXPERIMENTATION OF A GRAPHIC SYSTEM OF MAN-COMPUTER COMMUNICATION. I WILL FIRST BRIEFLY DESCRIBE THE SYSTEM UPON WHICH THE EXPERIMENTS WERE PERFORMED. THEN I WILL PRESENT ALL THE PORTION OF THE PROGRAMMING DEVELOPED BY US TO RENDER THE OPERATOR-COMUTER GRAPHIC COMMUNICATION POSSIBLE, AND FINALLY, I WILL DISCUSS QUICKLY SOME OF THE APPLICATIONS COMPLETED TO DATE. (A, ABBR.)

23P, 6R. COMMENTS:

THE DESCRIPTION OF BOTH THE GRAPHIC SYSTEM AND THE APPLICATIONS OF THIS SYSTEM ARE TOO BRIEF TO ALLOW AN ADEQUATE EVALUATION. THE PRINCIPAL THESIS OF THIS PAPER APPEARS TO BE THAT INTERACTIVE PROBLEM SOLVING IS USEFUL ONLY WHEN AN ALGORITHM FOR REACHING A SOLUTION USING THE COMPUTER ALONE IS NOT KNOWN AND WHEN THE USER IS REQUIRED TO RAPIDLY ASSIMILATE PRESENTED INFORMATION AND MAKE DECISIONS TO GUIDE THE SEARCH FOR A SOLUTION. APART FROM SOME VERY BRIEF AND INFORMAL DISCUSSIONS, THE AUTHOR FOCUSES ON HARDWARE AND SOFTWARE PROBLEMS RATHER THAN HUMAN FACTORS PROBLEMS IN INTERACTIVE GRAPHICS.

125 USE OF QUESTIONNAIRES IN USER REQUIREMENTS DEFINITION
DEVER, J.J. GATHERING SYSTEM USER DATA TO ASSIST IN THE DESIGN OF INFORMATION
PROCESSING SYSTEMS. PAPER PRESENTED AT MEETING OF THE HUMAN FACTORS SOCIETY,
LOS ANGELES, OCTOBER 1972 (REPRINTED BY BELL TELEPHONE LABORATORIES, HOLMDEL,
NJ; PROCEEDINGS CONTAIN ABSTRACT ONLY).
GESCRIPTION:

THIS PAPER HAS TWO GOALS: FIRST, TO DEMONSTRATE THAT DATA ON USER NEEDS CAN BE INEXPENSIVELY GATHERED AND THAT SYSTEM DESIGNERS ARE NOT ALWAYS AWARE OF USER NEEDS, AND SECOND, TO DEMONSTRATE THAT THESE DATA ARE USEFUL IN DEFINING SYSTEM FUNCTIONS, GUIDING DATA BASE DESIGN, SELECTING INDIVIDUALS FOR TRAINING, DEVELOPING TRAINING PROGRAMS, AND FOR DESCRIBING COMPLEX JOBS. THESE GOALS ARE DISCUSSED IN CONJUNCTION WITH A QUESTIONNAIRE USED TO GATHER USER NEED DATA.

COMMENTS:

THIS PAPER IS CONCERNED WITH THE USE OF A QUESTIONNAIRE TO OBTAIN DATA ON THE IMPORMATION NEEDS OF THE POPULATION OF CANDIDATE USERS OF AN INFORMATION SYSTEM. THE QUESTIONNAIRE WAS ACTUALLY USED PRIMARILY TO OBTAIN DATA ABOUT THE PROPORTION OF EACH SUBJECT'S TIME SPENT IN EACH OF SEVERAL ACTIVITIES. SUGGESTIONS ARE GIVEN FOR CONSTRUCTION OF SUCH A QUESTIONMAIRE. RESULTS OF A SPECIFIC ADMINISTRATION OF THE QUESTIONNAIRE ARE GIVEN, AND AN ATTEMPT IS MADE TO RELATE THE QUESTIONNAIRE TO PROBABLE INFORMATION NEEDS AND TO POSSIBLE SELECTION OF APPROPRIATE INDIVIDUALS (BASED ON THEIR INFORMATION NEEDS) FOR TRAINING IN THE USE OF THE SYSTEM. UNFORTUNATELY, SELF-ESTIMATES OF TIME SPENT IN SPECIFIC JOB-RELATED ACTIVITIES ARE NOTORIOUSLY POOR. IF ABSOLUTE ESTIMATES OF TIME PER ACTIVITY ARE REQUIRED, IT IS VERY UNLIKELY THAT THIS QUESTIONNAIRE APPROACH WILL YIELD VALID RESULTS. FOR THOSE CASES IN WHICH RELATIVE TIME EXPENDITURES FOR VARIOUS ACTIVITIES ARE SUFFICIENT, HOWEVER, THE APPROACH ADVOCATED KERE MAY BE USEFUL. THIS IS A VERY ROUGH PAPER, EVEN CONSIDERING THAT IT IS A "SPEAKING" PAPER RATHER THAN A POLISHED "PROCEEDINGS" VERSION. ONLY HIGHLY NOTIVATED READERS WITH A VERY SPECIFIC INTEREST IN THE USE OF QUESTIONNAIRES FOR USER REQUIREMENTS ANALYSIS SHOULD BOTHER WITH THE PAPER ITSELF.

126 MANUAL DATA ENTRY TECHNIQUES
DEVOE, D.B. ALTERNATIVES TO HANDPRIMTING IN THE MANUAL ENTRY OF DATA. IEEE
TRANSACTIONS ON HUMAN FACTORS IN ELECTRONICS, 1967, HFE-8, 21-32.
DESCRIPTION:

MANY AUTOMATED DATA-HANDLING SYSTEMS STILL REQUIRE THE HANDPRINTING OF ENTRIES ON SPECIAL FORMS AS AN INITIAL STEP. THIS INVESTIGATION SOUGHT AND EVALUATED METHODS FOR BYPASSING HANDPRINTING IN THE MANUAL ENTRY OF DATA INTO COMPUTERS. THREE LABORATORY EXPERIMENTS WERE PERFORMED TO OBTAIN DATA ON HUMAN PERFORMANCE RATES IN VARIOUS INPUT MODES, INCLUDING WRITING, PRINTING, MARKING, AND KEYING WITH BOTH PRINT AND SCOPE FEEDBACK. IT IS ESTIMATED THAT CONVERSION TO NEW INPUT METHODS MIGHT INITIALLY SLOW DOWN THE INPUT RATE OF ANALYSTS WHO FORMERLY HANDPRINTED THEIR ENTRIES BUT THAT PRACTICE WOULD BE LIKELY TO RESTORE FORMER SPEEDS. (A) 12P, 13R.

COMMENTS:

THIS PAPER DESCRIBES A SERIES OF EXPERIMENTS TO EVALUATE THE RELATIVE SPEED OF VARIOUS METHODS OF DATA ENTRY. IN GENERAL, THESE EXPERIMENTS APPEAR TO HAVE BEEN WELL DONE. THE METHODS COMPARED WERE HANDWRITING, UNCONSTRAINED HANDPRINTING, TYPING (BY UNSKILLED TYPISTS), CONSTRAINED HANDPRINTING, AND MARK SENSING. DATA ENTRY WAS, IN MOST CASES, ONTO PREPARED FORMS AND THERE IS ONLY INFORMAL CONSIDERATION OF THE TOTAL TIME REQUIRED TO ENTER DATA AND TRANSFORM IT INTO A COMPUTER ACCEPTABLE FORM.

127 STUDIES OF MANAGEMENT DECISION AIDS
DICKSON, G.W., SENN, J.A., & CHERVANY, N.L. RESEARCH IN MANAGEMENT
INFORMATION SYSTEMS: THE MINNESOTA EXPERIMENTS. MANAGEMENT SCIENCE, 1977,
23(9), 913-923.
DESCRIPTION:

THE USE OF COMPUTER BASED INFORMATION-DECISION SYSTEMS TO SUPPORT DECISION MAKING IN ORGANIZATIONS HAS INCREASED SIGNIFICANTLY IN THE LAST DECADE. VERY LITTLE EFFORT HAS BEEN DEVOTED, HOWEVER, TO DETERMINE WHAT RELATIONSHIPS EXIST BETWEEN THE STRUCTURE OF INFORMATION PRESENTED FOR DECISION MAKING AND THE ENSUING EFFECTIVNESS OF THE DECISION. THIS ARTICLE SUMMARIZES A SERIES OF EXPERITENTS, THE MINNESOTA EXPERIMENTS, WHICH WERE CONDUCTED TO EXAMINE THE SIGNIFICANCE OF VARIOUS INFORMATION SYSTEM CHARACTERISTICS ON DECISION ACTIVITY. SEVERAL RESEARCH PROGRAMS ADMINISTERED IN THE PERIOD 1970-1975 ARE DISCUSSED IN THIS PAPER. BY VARYING THE MANNER IN WHICH INFORMATION WAS PROVIDED TO PARTICIPANTS IN EACH EXPERIMENT, THE IMPACT OF VARIOUS INFORMATION SYSTEM CHARACTERISTICS AND INDIVIDUAL DIFFERENCES ON DECISION EFFECTIVENESS WAS INVESTIGATED. ANALYSIS OF THE RESULTS SHOWS THAT, IN MANY CASES, THE DECISION/DECISION-MAKING PROCESS OF THE PARTICIPANTS WAS AFFECTED BY THE INFORMATION SYSTEM STRUCTURE AND/OR ATTRIBUTES OF INDIVIDUAL DECISION MAKERS. THE RESULTS SUGGEST GUIDELINES FOR THE DESIGNERS OF INFORMATION SYSTEMS AND FRUITFUL AVENUES FOR CONTINUED RESEARCH. (A) 11P, 42R.

COMMENTS:

THE EXPERIMENTS REPORTED IN THIS PAPER ARE DESCRIBED IN TOO LITTLE DETAIL TO ALLOW COMMENTS ON THEIR VALIDITY OR GENERALITY. TAKEN TOGETHER, THESE EXPERIMENTS, IF WELL DONE, MAKE A SIGNIFICANT CONTRIBUTION TO RESEARCH ON MANAGEMENT INFORMATION SYSTEMS AND MANY OF THE CONCLUSIONS MAY ALSO APPLY TO OTHER TYPES OF MAN-MACHINE SYSTEMS. THE CONCLUSIONS, ALSO STATED VERY BRIEFLY, DEAL WITH USER ACCEPTANCE, OUTPUT DEVICES AND TECHNIQUES, AND INDIVIDUAL DIFFERENCES IN USERS. PERHAPS THE MOST SIGNIFICANT CONTRIBUTION OF THIS PAPER IS TO SHOW THAT MANAGEMENT INFORMATION SYSTEMS CAN BE STUDIED IN CONTROLLED LABORATORY SETTINGS WHICH, IN VIEW OF THE ASSOCIATED EXPERIMENTAL DESIGN AND CONTROL, ARE TO BE PREFERRED OVER CASE STUDIES OR FIELD STUDIES.

128 SCANNING AND PHOSPHOR PROPERTIES OF CRT DISPLAYS
DILL, A.B., & GOULD, J.D. FLICKERLESS REGENERATION RATES FOR CRT DISPLAYS AS A
FUNCTION OF SCAN ORDER AND PHOSPHOR PERSISTENCE. HUMAN FACTORS, 1970, 12,
465-471.
DESCRIPTION:

THE EFFECTS OF TWO VARIABLES ON THE REGENERATION RATES REQUIRED TO PREVENT FLICKER ON CRT DISPLAYS WERE INVESTIGATED IN THIS COMPUTER-AUTOMATED EXPERIMENT. THE TWO VARIABLES WERE THE SEQUENTIAL ORDER IN WHICH THE DISPLAY WAS SCANNED (E.G., HORIZONTAL, VERTICAL, OR PSEUDO-RANDOM SCANNING) AND THE PERSISTENCE OF THE PHOSPHOR ON THE DISPLAY. TWENTY-ONE DIFFERENT SCAN ORDERS AND TWO PHOSPHORS (?-12 AND P-38) WERE USED. RESULTS SHOWED THAT FLICKERLESS REGENERATION RATES DEPENDED PRINCIPALLY UPON PHOSPHOR PERSISTENCE; SCAN ORDER HAD ONLY A MINOR INFLUENCE. THE MAIN EFFECT OF RANDOM AND PSEUDO-RANDOM SCANNING WAS TO REDUCE THE DISTURBING EFFECTS OF DISPLAY FLICKER WHEN IT DID OCCUR, RATHER THAN TO REDUCE SIGNIFICANTLY THE REGENERATION RATE AT WHICH FLICKER DID OCCUR. (A)

7P, 16R. COMMENTS:

THIS PAPER WAS INTENDED TO BE THE FIRST CONTROLLED TEST OF THE ASSUMPTION THAT THE FLICKER-FREE REGENERATION RATE OF A CRT DISPLAY IS A FUNCTION OF SCAN ORDER. IN GENERAL, THIS EXPERIMENT WAS CAREFULLY CONTROLLED. THE PRIMARY CRITICISM IS THAT ONLY TWO SUBJECTS WERE USED. IF INDIVIDUAL DIFFERENCES IN CRITICAL FLICKER FREQUENCY ARE SIGNIFICANTLY LARGE, THE REGENERATION RATES REPORTED IN THIS PAPER MIGHT CAUSE FLICKER FOR SOME CRT USERS BUT NOT FOR OTHERS. ONE CONCLUSION THAT CAN BE DRAWN FROM THIS EXPERIMENT IS THAT MORE COMPLEX SCAN ORDERS ARE NOT APPRECIABLY BETTER THAN THE STANDARD 2-LINE INTERLACE RASTER SCAN.

129 INFORMATION RETRIEVAL SYSTEMS
DINTER, H. DESIGN CRITERIA FOR A MAN-MACHINE INFORMATION TRANSFER SYSTEM.
IN L. SCHULTZ (ED.), THE INFORMATION BAZAAR: 6TH ANNUAL NATIONAL COLLOQUIUM
ON INFORMATION RETRIEVAL. PHILADELPHIA, PENNSYLVANIA: THE COLLEGE OF
PHYSICIANS OF PHILADELPHIA, MEDICAL DOCUMENTATION SERVICE, 1969, 15-22.
DESCRIPTION:

THE AMOUNT OF AVAILABLE KNOWLEDGE IS INCREASING RAPIDLY. THE BODY OF SCIENTIFIC AND TECHNICAL KNOWLEDGE IS NOT INFORMATION, HOWEVER, UNLESS THE POTENTIAL USER IS AWARE OF ITS EXISTENCE AND CONTENT AND CAN ACCESS IT. THIS PAPER CONSIDERS THE FEASIBILITY AND DESIGN CRITERIA FOR A SYSTEM THAT ALLOWS REAL-TIME INFORMATION AVAILABILITY.

COMMENTS:

THIS IS A NON-TECHNICAL PAPER THAT ATTEMPTS TO PRESENT ARGUMENTS IN FAVOR OF THE DEVELOPMENT OF COMPUTER-BASED INFORMATION RETRIEVAL SYSTEMS.
GENERALIZATIONS ARE MADE ABOUT THE "INFORMATION EXPLOSION" AND THE DIFFICULTY IN ACCESSING RELEVANT INFORMATION AND ABOUT THE FEASIBILITY OF COMPUTER-BASED INFORMATION RETRIEVAL SYSTEMS. THE DESIGN CRITERIA THAT ARE PRESENTED ARE VAGUE (E.G., EASY TO USE, PEOPLE-ORIENTED, RELIABLE) AND DO NOT CONSTITUTE USEFUL GUIDELINES FOR THE SYSTEM DESIGNER.

APPROPRIATE PROPERTIES OF TIME-SHARING SYSTEMS
DOHERTY, W.J., THOMPSON, C.H., & BOIES, S.J. AN ANALYSIS OF INTERACTIVE SYSTEM
USAGE WITH RESPECT TO SOFTWARE, LINGUISTIC, AND SCHEDULING ATTRIBUTES. IN
PROCEEDINGS OF THE 1972 INTERNATIONAL CONFERENCE ON CYBERNETICS AND SOCIETY.
NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., 1972,
113-119 (ALSC TECHESCAL REPORT RC-3914, IBM WATSON RESEARCH CENTER, YORKTOWN
HEIGHTS, NY, 1972).
DESCRIPTION:

A QUALITY INTERACTIVE SYSTEM SHOULD ENHANCE A PERSON'S ABILITY TO DO WORK IN A SATISFYING AND EFFICIENT MANNER. THIS PAPER IS ORGANIZED AROUND THREE ASPECTS OF QUALITY FOR AN INTERACTIVE SYSTEM. WE WILL PRESENT OUR EXPERIENCE WITH RESPECT TO (1) THE FUNCTIONS (SOFTWARE) WHICH SHOULD BE INCLUDED IN AN INTERACTIVE SYSTEM, (2) THE TECHNIQUES REQUIRED TO ACHIEVE AND MAINTAIN USER SATISFACTION AND (3) THE TECHNIQUES NECESSARY FOR EFFECTIVE INSTALLATION MANAGEMENT. THE IMPORTANCE OF EDITING, THE PROBLEMS OF ON-LINE DATA MANAGEMENT, AND RESPONSE TIME CORRELATIONS TO USER BEHAVIOR ARE SOME OF THE KEY FINDINGS PRESENTED HERE. OUR OBSERVATION THAT INTERACTIVE SYSTEMS ARE EVOLUTIONARY IN NATURE, CONTINUALLY REFLECTING THE GROWTH OF NEW APPLICATIONS, NEW HARDWARE, AND NEW UNDERSTANDING OF WHAT IS POSSIBLE, IMPLIES THAT PROVISIONS MUST BE MADE FOR CONTROLLING AND NOURISHING THIS GROWTH IN A STIMULATING AND RESPONSIVE WAY. (A)

7P, 10R. COMMENTS:

THIS PAPER CONTAINS A NUMBER OF SUGGESTIONS CONCERNING PROPERTIES WHICH INTERACTIVE COMPUTING SYSTEMS SHOULD HAVE IN ORDER TO SUPPORT USER NEEDS AND IMPROVE USER PRODUCTIVITY AND ATTITUDES. ALTHOUGH THESE SUGGESTIONS WERE PRESUMBLY DERIVED FROM THE AUTHORS' ANALYSIS OF USAGE DATA FROM A LARGE TIME-SHARING SYSTEM, THE DATA ARE NOT PRESENTED. PORTIONS OF THE DATA HAVE BEEN REPORTED ELSEWHERE BY VARIOUS OF THESE AUTHORS, BUT THE ABSENCE OF EVEN A BRIEF SUMMARY OF THE RAW DATA IN THIS REORT REDUCES ITS VALUE SOMEWHAT. SOME OF THE SUGGESTIONS MADE HERE ARE BEHAVIORALLY INSIGHTFUL AND DESERVING OF ATTENTION. MANY OF THE RECOMMENDED PROPERTIES ARE STILL FOUND ONLY RARELY IN MODERN OPERATING SYSTEMS. THE AUTHORS' SUGGESTION THAT SYSTEMS DELIVER A WARNING MESSAGE SHORTLY BEFORE THEIR RESPONSE TO THE USER'S INPUT IS SOMEWHAT CONTROVERSIAL, BUT DESERVES EMPIRICAL TEST. MOST OF THE REMAINING RECOMMENDATIONS ARE CLEARLY SOUND, AND THE PAPER SHOULD INTEREST THOSE CONCERNED WITH THE GENERAL PROPERTIES OF INTERACTIVE PROGRAMMING AND EDITING SYSTEMS.

131 FUNCTIONAL SPECIFICATIONS FOR TELETYPEWRITER TERMINALS
DOLOTTA, T.A. FUNCTIONAL SPECIFICATIONS FOR TYPEWRITER-LIKE TIME-SHARING
TERMINALS. COMPUTING SURVEYS, 1970, 2, 5-31.
DESCRIPTION:

A SET OF DETAILED FUNCTIONAL SPECIFICATIONS IS PRESENTED HERE FOR TYPEWRITER-LIKE TERMINALS (E.G., TELETYPEWRITERS) TO BE USED ON-LINE WITH TIME-SHARING COMPUTER SYSTEMS. THE EMPHASIS IS ON THE FUNCTIONS TO BE PROVIDED (RATHER THAN ON THE SPECIFICS OF THE IMPLEMENTATION OF SUCH FUNCTIONS), AS WELL AS ON USER NEEDS AND ON HUMAN FACTORS RELEVANT TO SUCH TERMINALS. NONE OF THE FEATURES DESCRIBED PRESENTS ANY MAJOR TECHNOLOGICAL OR MANUFACTURING PROBLEMS. THUS, THIS PAPER CAN BE VIEWED AS A STATEMENT, OFFERED FOR THE BENEFIT OF THE MANUFACTURERS AND DESIGNERS OF SUCH TERMINALS, OF USER NEEDS WHICH EXIST IN THIS AREA, AS WELL AS AN IN-DEPTH TUTORIAL ON THE SUBJECT TOPIC. (A)

27P, 25R. COMMENTS:

THIS IS A VERY DETAILED SET OF SPECIFICATIONS FOR TELETYPEWRITER TERMINALS. MANY OF THE PROPERTIES SPECIFIED ARE ALSO RELEVANT FOR CRT AND OTHER TERMINAL TYPES. FROM A HUMAN FACTORS VIEWPOINT, THE SPECIFICATIONS ARE REASONABLY WELL BONE. THEY CONCERN BOTH BASIC HARDWARE PROPERTIES AND FUNCTIONAL PROPERTIES WHICH INVOLVE BOTH HARDWARE AND SOFTWARE. IN SOME RESPECTS THE SPECIFICATIONS CONSTITUTE A "STRAW MAN" PROPOSED IN ORDER TO MAKE TERMINAL DESIGNERS AWARE OF HUMAN FACTORS ISSUES AND TO PROVOKE POSITIVE DEVELOPMENTS IN TERMINAL DESIGN, EVEN IF THOSE DEVELOPMENTS TAKE A DIFFERENT FORM THAN THAT SUGGESTED HERE. THE DIFFICULTY WITH DETAILED SPECIFICATIONS IS THAT THEY REPRESENT ONLY A SINGLE SOLUTION TO THE UNDERLYING PROBLEMS. MANY OTHER SOLUTIONS, PERHAPS EQUALLY GOOD, MIGHT BE PROPOSED. THIS CAN RESULT IN AN UNFORTUNATE TENDENCY FOR SUCH SPECIFICATIONS TO BE IGNORED. THIS ONE SHOULD BE CONSIDERED BY THOSE WHO ARE DESIGNING OR SELECTING TERMINALS, ESPECIALLY TELETYPEWRITER TERMINALS.

132 INTERACTIVE PROCESS CONTROL
DOUTRIAUX, J. HUMAN-COMPUTER PROCESS CONTROL: BETTER TRAINING AND BETTER
PERFORMANCE FOR THE PRINTING INDUSTRY. IN PROCEEDINGS OF THE 17TH ANNUAL
MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS
SOCIETY, 1973, 111-115.
DESCRIPTION:

INSTEAD OF COMPLETE AUTOMATION, AN EVOLUTIONARY APPROACH TO AUTOMATIC CONTROL IS RECOMMENDED FOR SOME SYSTEMS AND THE SUCCESSIVE STAGES OF GROWTH OF THE CONTROL SYSTEM ARE DESCRIBED. AN APPLICATION TO THE PRINTING INDUSTRY RESULTS IN THE DEVELOPMENT OF A SMALL ON-LINE COMPUTER-ASSISTED CONTROL SYSTEM WHERE THE COMPLEMENTARY CHARACTERISTICS OF THE COMPUTER AND OF THE HUMAN ARE USED. APPLICATION OF THE APPROACH ON A COMPUTER-BASED MODEL OF A PRESS AND DISCUSSION OF THE RESULTS OBTAINED BY EXPERIENCED PRESSMEN ARE GIVEN. THE STUDY RESULTS IN A COMPUTER-ASSISTED MANUAL CONTROL OF A LITHOGRAPHIC PRINTING PRESS WHICH CAN BE MORE DEVELOPED AND APPLIED TO OTHER TYPES OF INDUSTRIAL PROCESSES, AND IN THE IMPLEMENTATION OF A MODEL OF A SIMPLIFIED LITHOGRAPHIC PRESS WHICH CAN BE USED TO TRAIN NOVICE OPERATORS. (A)

5P, 2R.

THE TYPE OF SYSTEM PROPOSED IN THIS PAPER COULD BE A VALUABLE AID IN A NUMBER OF MAN-COMPUTER PROBLEM SOLVING TASKS. SOME TYPES OF TASKS REQUIRE THE HUMAN PROBLEM SOLVER TO FORM FAIRLY COMPLICATED SOLUTION STRATEGIES AND EXECUTE THESE STRATEGIES QUICKLY AND ACCURATELY. WHEN SUCH STRATEGIES REQUIRE THAT SEVERAL ENVIRONMENTAL ASPECTS BE MONITORED AND SEVERAL DIFFERENT TYPES OF ACTIONS BE TAKEN, THE AMOUNT OF INFORMATION THAT SHOULD BE PROCESSED MAY EXCEED THE HUMAN DPERATOR'S ABILITIES. THE SYSTEM DISCUSSED IN THIS PAPER "LEARNS" THE HUMAN PROBLEM SOLVER'S SOLUTION STRATEGY. SUCH A SYSTEM COULD THEN MONITOR THE ENVIRONMENT AND SUGGEST ACTIONS THAT SHOULD BE TAKEN. ALTHOUGH CONCLUSIVE EMPIRICAL DATA ARE NOT PRESENTED, THE DATA THAT ARE PRESENTED SUGGEST THAT USERS MAY BE RELUCTANT TO USE SUCH A SYSTEM; THIS IS AN ISSUE THAT SHOULD BE CONSIDERED FURTHER. A SIMILAR AIDING MECHANISM, AUTOMATIC TAKEOVER, IS DISCUSSED IN G. WELTMAN, R. STEEB, A. FREEDY, M. SMITH, AND R. WEISBROD (1973).

133 KEYBOARDS AND OPERATOR FATIGUE
DUNCAN, J., 3 FERGUSON, D. KEYBOARD OPERATING POSTURE AND SYMPTOMS IN
OPERATING. ERGONOMICS, 1974, 17, 651-662.
DESCRIPTION:

A TRIAL OF PHYSIOTHERAPY FOR MUSCLE INCOORDINATION AND ACHING (OCCUPATIONAL CRAMP AND MYALGIA) IN TELEPRINTER OPERATORS REVEALED AN ASSOCIATION BETWEEN THESE TYPES OF SYMPTOMS OF OPERATING DIFFICULTY AND DISADVANTAGEOUS OPERATINC POSTURES, WHICH IN TURN WERE THOUGHT TO BE RELATED TO KEYBOARD LAYOUT. THE PURPOSE OF THIS PAPER IS TO ANALYSE THE RELATIONSHIP BETWEEN POSTURE AND SYMPTOMS. SUBJECTS OF SYMPTOMS AND UNAFFECTED OPERATORS WERE INTERVIEWED, TESTED IN VARIOUS WAYS, AND OBSERWED IN TELEPRINTER OPERATING. ADVERSE OPERATING POSTURES OF ARM AND HAND WERE, WITH THE EXCEPTION OF TWO TYPES OF POSTURE, MORE OFTEN RIGHT THAN LEFT SIDED (WHEN THEY WERE NOT BILATERAL) AND COMMONER IN SUBJECTS THAN CONTROLS. EVERY PART OF THE UPPER LIMB WHICH WAS A SITE OF SYMPTOMS IN OPERATING WAS MORE OFTEN AFFECTED ON THE RIGHT SIDE THAN THE LEFT (WHEN NOT BILATERALLY AFFECTED). PART OF LIMB AFFECTED WAS USUALLY ASSOCIATED WITH SOME ADVERSE OPERATING POSTURE OF THAT REGION. IT WAS CONCLUDED THAT KEYBOARD DESIGN AND WORK HEIGHT PREDISPOSE TO OPERATING POSTURES WHICH IN SOME OPERATORS GIVE RISE TO SYMPTOMS IN OPERATING. (A)

THIS ARTICLE CONVINCINGLY RELATES BAD OPERATOR POSTURE TO CRAMPS AND MUSCLE PAINS IN KEYBOARD ENTRY TASKS. THIS RESULT IS NOT SURPRISING. THE AUTHORS SUGGEST, BUT DO NOT DEMONSTRATE, THAT ADVERSE OPERATING POSTURE RESULTS FROM POOR KEYBOARD AND WORK STATION DESIGN.

134 WIDEBAND MAN-COMPUTER INTERACTION TECHNIQUES
DUNN, R.M. HARDWARE FOR WIDEBAND INTERACTION FOR COMPUTER GRAPHICS. IN
PROCEEDINGS, IEEE INTERNATIONAL CONFERENCE ON CYBERNETICS AND SOCIETY, NOVEMBER
1976. NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., 1976,
443-446.
DESCRIPTION:

INTERACTION HARDWARE FOR COMPUTER GRAPHICS MUST SUPPORT BOTH HUMAN COGNITION AND HUMAN EXPRESSION IN THE INTERACTIVE DIALOGUE BETWEEN HUMAN AND MACHINE. THIS HARDWARE MUST ALSO BE CAPABLE OF BEING INTEGRATED INTO THE TOTAL MACHINE SYSTEM VIA INTERFACES THAT DO NOT NARROW THE MAN-MACHINE COMMUNICATION CHANNEL. THE HARDWARE MUST ALSO BE CAPABLE OF BEING INTEGRATED INTO THE MAN-MACHINE INTERFACE SO THAT NEGATIVE PHYSICAL OR PSYCHOLOGICAL HUMAN FACTORS ARE NOT INVOKED.

IN THIS PAPER, CURRENT AND POTENTIAL FUTURE INPUT AND OUTPUT HARDWARE WILL BE CONSIDERED FOR CERTAIN CLASSES OF SIGNALS CAPABLE OF BEING GENERATED AND DETECTED BY BOTH HUMAN AND MACHINE ALIKE. THESE CONSIDERATIONS WILL INCLUDE SIGNALS THAT CONVEY INFORMATION BY OPTICAL, AURAL, ORAL, AND NEURO-MUSCULAR MEANS. (A, ABBR.)

4P, 9R.

AS THE AUTHOR NOTES, THE PURPOSE OF THIS PAPER IS TO PROVOKE IMAGINATION RATHER THAN REVIEW THE CURRENT STATE OF THE ART IN HARDWARE FOR INTERACTIVE APPLICATIONS. THIS PAPER WOULD NOT BE RECOMMENDED, THEREFORE, TO ANYONE WISHING SUCH A REVIEW. THIS PAPER DDES, HOWEVER, CONTAIN A NUMBER OF INTERESTING IDEAS AND SUGGESTIONS FOR ADDITIONAL RESEARCH AND DEVELOPMENT. WIDEBAND INTERACTION, THAT INCORPORATES SEVERAL POSSIBLE COMMUNICATION CHAMMELS, WOULD BE USEFUL IN THAT THE CHANNEL MOST APPROPRIATE FOR THE INFORMATION TO BE CONVEYED COULD BE SELECTED. WHETHER INCREASING THE NUMBER OF AVAILABLE COMMUNICATION CHANNELS WOULD INCREASE THE AMOUNT OF INFORMATION EITHER THE HUMAN OR COMPUTER COULD PROCESS IS UNCLEAR. THEORIES DEVELOPED IN COGNITIVE PSYCHOLOGY SUGGEST THAT THIS IS A VERY COMPLEX QUESTION AND SEVERAL FACTORS AND VARIABLES NEED TO BE CONSIDERED. THIS ISSUE SHOULD PERHAPS BE CONSIDERED FURTHER BEFORE HARDWARE TO SUPPORT WIDEBAND INTERACTION IS DEVELOPED.

135 USE OF APPROPRIATE INFORMATION STRUCTURES
DURDING, B.M., BECKER, C.A., & GOULD, J.D. DATA ORGANIZATION (RESEARCH
REPORT RC-4956). YORKTOWN HEIGHTS, NEW YORK: IBM WATSON RESEARCH CENTER,
JULY 1974.

THREE EXPERIMENTS INVESTIGATED HOW PEOPLE ORGANIZE DATA. SUBJECTS WERE GIVEN SETS OF 15-20 WORDS AND ASKED TO ORGANIZE THEM. EACH WORD SET HAD A PRE-DEFINED ORGANIZATION (HIERARCHY, NETWORK, LISTS, TABLE, RANDOM) BASED ON THE SEMANTIC RELATIONS AMONG THE WORDS. EXPERIMENT 1 SHOWED THAT COLLEGE STUDENTS HAVE THESE ORGANIZATION STRUCTURES AVAILABLE FOR USE. THEY ORGANIZED MOST WORD SETS ON THE BASIS OF THE SEMANTIC RELATIONS INHERENT IN THE DATA. WHEREAS MOST SUBJECTS USED "APPROPRIATE" ORGANIZATIONS (THOSE THAT MOST EASILY PRESERVED THE RELATIONS), A FEW SUBJECTS ORGANIZED NEARLY ALL WORD SETS INTO LISTS. EXPERIMENT 2 SHOWED THAT SUBJECTS CAN EFFICIENTLY FIT THE WORD SETS INTO "SKELETONS" THAT WERE EXPLICITLY DESIGNED TO MAINTAIN ALL THE SEMANTIC RELATIONS AMONG THE WORDS. EXPERIMENT 3 SHOWED THAT SUBJECTS HAVE DIFFICULTY IN PRESERVING THE RELATIONS AMONG DATA WHEN THEY WERE REQUIRED TO ORGANIZE THE DATA INTO INAPPROPRIATE STRUCTURES. THESE RESULTS ARE EVALUATED RELATIVE TO THE USE OF COMPUTER-BASED INFORMATION RETRIEVAL SYSTEMS. (A)

40P, 17R.

COMMENTS:

THIS IS A NOVEL AND INTERESTING SERIES OF EXPERIMENTS. BASICALLY, THE EXPERIMENTS DEMONSTRATED THAT DIFFERENT LOGICAL IMFORMATION STRUCTURES (AS DISTINGUISHED FROM PHYSICAL FILE STRUCTURES) ARE APPROPRIATE FOR DIFFERENT SITUATIONS, AND THAT AN ATTEMPT TO FORCE THE USER OF A DATA BASE TO USE AN INAPPROPRIATE INFORMATION STRUCTURE WILL RESULT IN A DEGRADATION OF PERFORMANCE. THE SUBJECTS TASK WAS RATHER ABSTRACT, BUT THE RESULTS ARE BELIEVABLE AND PROBABLY APPLY SIMILARLY TO "REAL-WORLD" TASKS INVOLVING DATA ENTRY AND USE OF A STRUCTURED DATA BASE. AS IS DEFEN THE CASE, THE STUDY RAISES MORE QUESTIONS THAN IT ANSWERS. WHILE IT MAKES US AWARE THAT LOGICAL INFORMATION STRUCTURE IS A RELEVANT FACTOR IN MAN-COMPUTER COMMUNICATION, AND THAT COMPUTER SYSTEM USERS CAM BE EXPECTED TO BE ABLE TO USE SEVERAL SUCH STRUCTURES (SOME MORE SATISFACTORILY THAN OTHERS), IT DOES NOT ADDRESS THE MORE COMPLICATED ISSUE OF DETERMINING THE APPROPRIATE STRUCTURE FOR A SPECIFIC SITUATION. IT MAY, THEREFORE, LEAVE THE APPLICATION-ORIENTED READER SOMEWHAT COLD. IT IS, HOWEVER, A GOOD PIECE OF BASIC RESEARCH, AND ITS EXPERIMENTAL METHOD MAY VERY WELL HELP ANSWER THESE MORE PPLIED QUESTIONS. THIS APPEARS TO BE A POTENTIALLY PRODUCTIVE LINE OF RESEARCH.

136 INTERACTIVE AID FOR MULTIPLE-CRITERION DECISION MAKING
DYER, J.S. AN EMPIRICAL INVESTIGATION OF A MAN-MACHINE INTERACTIVE APPROACH TO
THE SOLUTION OF THE MULTIPLE CRITERIA PROBLEM. IN J.L. COCHRANE & M. ZELENY
(EDS.), MULTIPLE CRITERIA DECISION MAKING. COLUMBIA, SOUTH CAROLINA: UNIVERSITY
OF SOUTH CAROLINA PRESS, 1973, 202-216.
DESCRIPTION:

THIS PAPER PRESENTS A DESCRIPTION AND AN EVALUATION OF A TIME-SHARING COMPUTER PROGRAM WRITTEN TO IMPLEMENT A MAN-MACHINE INTERACTIVE OPTIMIZATION APPROACH TO THE SOLUTION OF THE MULTIPLE CRITERIA PROBLEM. THIS APPROACH WAS SUGGESTED IN A RECENT PAPER BY GEOFFRION (A. GEOFFRION, "VECTOR MAXIMAL DECOMPOSITION PROGRAMMING," WORKING PAPER NO. 164, WESTERN MANAGEMENT SCIENCE INSTITUTE, UNIVERSITY OF CALIFORNIA, LOS ANGELES, SEPTEMBER 1970). NIME SUBJECTS WERE ASKED TO USE THE PROGRAM TO SOLVE A HYPOTHETICAL PROBLEM INVOLVING MULTIPLE CRITERIA, AND TO RATE THE PROCEDURE IN TERMS OF THE DIFFICULTY OF ITS USE, AND THEIR CONFIDENCE IN THE SOLUTION THEY OBTAINED. THE ANALYSIS OF THEIR EXPERIENCES INDICATES THAT THE TIME-SHARING PROGRAM CAN BE USED SUCCESSFULLY BY RELATIVELY UNSOPHISTICATED DECISION-MAKERS. (A) 15P, 13R.

COMMENTS:

THE PRIMARY EMPHASIS OF THIS PAPER IS ON AN ALGORITHM FOR SOLVING MULTIPLE-CRITERION PROBLEMS. WHILE THE AUTHOR DEMONSTRATES THAT INDIVIDUALS WITH NO FORMAL TRAINING IN MULTI-ATTRIBUTE DECISION THEORY OR THE USE OF INTERACTIVE SYSTEMS CAN SUCCESSFULLY USE THIS SYSTEM, THIS DOES NOT NECESSARILY IMPLY THAT THE ALGORITHM USED IS OPTIMAL. THE PRINCIPAL ADVANTAGE OF AN INTERACTIVE APPROACH TO DECISION MAKING MAY BE TO PRESENT ALTERNATIVES THAT THE DECISION MAKER WOULD NOT OTHERWISE CONSIDER AND TO CHECK THE CONSISTENCY OF THE DECISION MAKER'S JUDGMENTS OF ALTERNATIVES. WHETHER THE PERFORMANCE DIFFERENCES REPORTED IN THIS PAPER ARE DUE TO THESE ADVANTAGES OR TO THE SPECIFIC ALGORITHM USED CANNOT BE DETERMINED ON THE BASIS OF THE EXPERIMENT REPORTED HERE. THIS PAPER DOES INDICATE, HOWEVER, THE BENEFICIAL EFFECTS OF AN INTERACTIVE DECISION MAKING SYSTEM.

137 POINT-IN VS. TYPE-IN DATA ENTRY

EARL, W.K., & GOFF, J.D. COMPARISON OF TWO DATA ENTRY METHODS. PERCEPTUAL AND
MOTOR SKILLS; 1965, 20, 369-384.

DESCRIPTION:

THE PURPOSE OF THIS EXPERIMENT WAS TO MEASURE THE EFFECTS OF A NUMBER OF DISPLAY AND INPUT VARIABLES ON THE RELATIVE SPEED AND ACCURACY OF INPUT PERFORMANCE WHEN USING POINT-IN AND TYPE-IN DATA ENTRY METHODS FOR ENTERING ALPHABETICAL MATERIAL INTO AUTOMATIC DATA PROCESSING MACHINES. THE FACTORS TESTED IN THE EXPERIMENTAL DESIGN WERE: TYPES OF ARRANGEMENT OF DISPLAY MATERIAL, DENSITY OF MATERIAL, DIFFERENT TYPES OF INPUT TASKS, TYPING ABILITY, SEX, AND RELATIVE LOCATION OF THE KEYPUNCH DEVICE TO THE OPERATOR. THE MAJOR FINDING OF THIS STUDY WAS THAT THE POINT-IN DATA ENTRY METHOD WAS A MORE ACCURATE INPUT TECHNIQUE THAM EITHER THE TYPE-IN OR MIXED POINT-IN TYPE-IN DATA ENTRY METHODS WHEN MEASURED UNDER THE EFFECTS OF THE INDEPENDENT VARIABLES. (A)

COMMENTS:

THIS EXPERIMENT HAS SOME RATHER ARTIFICIAL TASK PROPERTIES (E.G., USE OF A GREASE PENCIL TO SIMULATE A LIGHTPEN OR OTHER POINT-IN DATA ENTRY DEVICE), BUT IS GENERALLY WELL CONCEIVED AND CONVINCINGLY REPORTED. VERY LARGE MULTIFACTOR EXPERIMENTAL DESIGNS, SUCH AS THAT EMPLOYED HERE, ARE SOMEWHAT OUT OF VOGUE NOW, AND IT IS DOUBTFUL THAT ENOUGH WAS LEARNED IN THIS CASE TO WARRANT THE SIMULTANEOUS STUDY OF 120 EXPERIMENTAL CONDITIONS. THE PRINCIPAL RESULTS ARE USEFUL, HOWEVER. THE EXPERIMENT PROVIDES A CONVINCING ARGUMENT THAT, FOR MOST PURPOSES, A POINT-IN MENU SELECTION DIALOGUE CAN BE MADE BOTH FASTER AND MORE ERROR-FREE THAN A TYPED (KEYBOARD) DIALOGUE, PROVIDING ALL OPTIONS CAN BE PRESENTED ON THE MENU SELECTION DISPLAY, AND THAT DISPLAY IS OF MANAGEABLE SIZE. IF THIS IS NOT POSSIBLE (I.E., IF SOME OPTIONS MUST STILL BE TYPED), PERFORMANCE MAY DEGRADE SIGNIFICANTLY. THE RESULTS WOULD SUGGEST THAT IN THE LATTER CASE, FOR ENTRY OF SINGLE SHORT WORDS, TYPING MAY RESULT IN BETTER PERFORMANCE. AS ONE WOULD EXPECT, THE AUTHORS ALSO FOUND THAT PERFORMANCE IS BETTER ON MENU SELECTION DISPLAYS WITH LOW DISPLAY DENSITY, AND THAT EXPERIENCED TYPISTS PERFORM BEST WHEN TYPE-IN INPUT IS INVOLVED.

### 138 MANAGER AS USER

EASON, K.D. A TASK-TOOL ANALYSIS OF MANAGER-COMPUTER INTERACTION. PAPER PRESENTED AT NATO ADVANCED STUDY INSTITUTE ON MAN-COMPUTER INTERACTION, MATI, GRECE, SEPTEMBER 1976 (REPRINTED BY DEPARTMENT OF HUMAN SCIENCES, UNIVERSITY DF TECHNOLOGY, LOUGHBOROUGH, LEICESTERSHIRE, ENGLAND). DESCRIPTION:

IN ORDER TO EXPLAIN THE CRITICAL COMMENT MADE BY MANAGERS ABOUT COMPUTER BASED MANAGEMENT INFORMATION SYSTEMS, A TASK-TOOL ANALYSIS IS MADE WHICH HIGHLIGHTS THE PROBLEMS OF SERVING THE INFORMATION REQUIREMENTS OF THE MANAGER'S TASK. THE RESPONSES OF THE MANAGER TO A TASK-TOOL MISMATCH ARE EXAMINED AND TWO (PARTIAL USE AND DISTANT USE) ARE DISCUSSED IN DETAIL. THE CONCLUSION REACHED IS THAT THE MANAGER IS A PARTICULARLY DIFFICULT CUSTOMER FOR THE COMPUTER AND THAT ACHIEVING EFFECTIVE MANAGER-COMPUTER INTERACTION. (A)

#### COMMENTS:

THIS IS AM EXCELLENT ANALYSIS OF THE PECULIAR USER INTERFACE PROBLEMS ENCOUNTERED WHEN THE USER OF THE SYSTEM IS A MANAGER. THE AUTHOR CITES SEVERAL QUESTIONNAIRE STUDIES OF MANAGER-USERS WHICH ARE NOT REPORTED IN DETAIL, BUT WHICH APPEAR TO LEND CREDENCE TO THE VIEWS EXPRESSED IN THE PAPER. BASICALLY, THE AUTHOR'S THESIS IS AS FOLLOWS: SYSTEMS MUST MATCH NOT ONLY THE TASK, BUT ALSO THE USER'S PERCEPTION OF HIS TASK; EACH USER WILL PERFORM HIS OWN COST-BENSFIT ANALYSIS OF THE SYSTEM; IF EVALUATION IS MEGATIVE, USER RESPONSE WILL DEPEND UPON AVAILABLE ALTERNATIVES AND UPON USER DISCRETION; MANAGERS ARE DIFFICULT USERS TO SATISFY BECAUSE THEIR INFORMATION REQUIREMENTS ARE HIGHLY VARIABLE, THEY PLACE HIGH NEGATIVE VALUE ON PERSONAL EFFORT REQUIRED TO USE THE SYSTEM, AND THEY HAVE MORE DISCRETION THAN OTHER USERS. THE AUTHOR'S DATA ALSO SUGGEST THAT A "SATISFICING" STRATEGY IS USED BY SYSTEM USERS; I.E., IF THE USER KNOWS A WAY TO ANSWER HIS QUESTION, EVEN THOUGH IT IS A POOR, EXPENSIVE WAY, HE WILL USE IT IN PREFERENCE TO SEARCHING FOR A NEW STRATEGY. THE AUTHOR PRESENTS QUESTIONNAIRE RESULTS CONCERNING MANAGER ACCEPTANCE OF THREE CLASSES OF SYSTEM: BATCH PROCESSED (STANDARD OUTPUT) SYSTEMS, DATA BASE SYSTEMS WITH RETRIEVAL FACILITIES, AND COMPUTER MODELS FOR DECISION EVALUATION. RESULTS SUGGEST THAT COMPUTER MODELS ARE PRESENTLY TOO RIGID, THAT STANDARD OUTPUTS MAY BE INHERENTLY UNSUITABLE, AND THAT DATA BASE SYSTEMS MAY BE MOST APPROPRIATE BUT STILL HAVE SIGNIFICANT EASE-OF-USE PROBLEMS. THIS IS AN EXCELLENT PAPER FOR THOSE CONCERNED WITH ANY CLASS OF USER INTERFACE, AND EXCELLENT PAPER FOR THOSE CONCERNED WITH ANY CLASS OF USER INTERFACE, AND EXCELLENT PAPER FOR THOSE CONCERNED WITH ANY CLASS OF USER INTERFACE, AND EXPECIALLY THOSE CONCERNED WITH MANAGEMENT INFORMATION SYSTEMS.

## 139 USER REQUIREMENTS ANALYSIS

EASON, K. HUMAN RELATIONSHIPS AND USER INVOLVEMENT IN SYSTEMS DESIGN. COMPUTER MANAGEMENT, MAY 1977, 10-12. DESCRIPTION:

HOW OFTEN HAVE FIRST CLASS SYSTEMS BEEN RUINED BECAUSE USERS COULD NOT OR WOULD NOT USE THEM? PROBLEMS OF THIS KIND MAY BE AVOIDED BY INVOLVING USERS IN THE PROCESS OF SYSTEMS DESIGN. HOWEVER, MANY SYSTEMS STAFF HAVE ATTEMPTED TO INVOLVE USERS, FOUND IT FRUSTRATING AND DIFFICULT, AND REVERTED TO OLD METHODS. THE AIM OF THIS ARTICLE IS TO EXAMINE THE BENEFITS AND DISADVANTAGES OF USER INVOLVEMENT AND TO DISCUSS THE VARIETY OF METHODS BY WHICH IT CAN BE ACCOMPLISHED. (A)

# 3P, OR.

THE AUTHOR BRIEFLY CONSIDERS THE ADVANTAGES AND DISADVANTAGES OF INVOLVING POTENTIAL USERS IN THE SYSTEM DESIGN PHASE. THE ADVANTAGES ARE PRIMARILY INVOLVED WITH USER ACCEPTANCE AND MORE ACCURATE IDENTIFICATION OF USER REQUIREMENTS WHILE THE DISADVANTAGES CENTER ON POTENTIAL DELAYS IN THE DESIGN EFFORT AND THE DIFFICULTY OF TRANSLATING USERS' STATED WANTS INTO PRECISE SPECIFICATIONS. THIS LAST DISADVANTAGE IS THE MORE SERIOUS AND THE VARIOUS TECHNIQUES FOR USER INVOLVEMENT DO NOT, PER SE, ADDRESS THIS PROBLEM. DESIGNERS AND USERS APPROACH A DESIGN PROBLEM WITH DIFFERENT VOCABULARIES TO DESCRIBE THE DESIGN. IT IS THE DESIGNER'S TASK TO FIND A COMMON LEVEL OF COMMUNICATION. MANY OF THE IDEAS CONTAINED IN THIS PAPER ARE RELEVANT TO THIS ISSUE AND THIS PAPER SHOULD BE OF GENERAL INTEREST TO DESIGNERS OF INTERACTIVE SYSTEMS.

140 FORMS OF MAN-COMPUTER INTERACTION
EASON, K.D., DAMODARAN, L., & STEWART, T.F.M. INTERFACE PROBLEMS IN MANCOMPUTER INTERACTION. IN E. MUMFORD & H. SACKMAN (EDS.), HUMAN CHOICE AND
COMPUTERS. AMSTERDAM: NORTH-HOLLAND, 1975, 91-105.
DESCRIPTION:

THE LITERATURE ON THE HUMAN ISSUES ASSOCIATED WITH THE INTERFACE BETWEEN MAN AND COMPUTER IS GROWING RAPIDLY, BUT IT IS LARGELY FRAGMENTED. ONE AUTHOR IS CONCERNED WITH ERRORS IN DATA INPUT, ANOTHER WITH KEYBOARD LAYOUT, AND STILL ANOTHER WITH CHARACTER DISPLAY. THE RESULT IS MORE OF A CATALOGUE THAN AN INTEGRATED BODY OF KNOWLEDGE AND STILL LESS IS IT A THEORY OF MAN-COMPUTER INTERACTION.

ONE OF THE REASONS FOR THIS STATE OF AFFAIRS IS THAT MAN-COMPUTER INTERACTION CAN TAKE MANY FORMS AND THE INTERFACE ISSUES MAY NOT BE THE SAME FOR ALL FORMS. IT IS OUR BELIEF THAT, BEFORE PRESENT KNOWLEDGE ABOUT INTERFACE ISSUES CAN BE MADE COHERENT, IT IS NECESSARY TO GENERATE CLASSIFICATIONS OF THE DIFFERENT FORMS MAN-COMPUTER INTERACTION CAN TAKE, AND OF THE INTERFACE ISSUES ASSOCIATED WITH EACH FORM. THIS PAPER PRESENTS SOME CLASSIFICATIONS WE HAVE DEVELOPED IN THE COURSE OF STUDYING THE FORMS OF INTERACTION EMPLOYED BY THE USERS OF 26 COMPUTER SYSTEMS IN GREAT BRITAIN. THIS SURVEY IS RESTRICTED TO THE NAIVE USERS OF COMPUTERS, WHOM WE DEFINE AS INDIVIDUALS WORKING WITHIN AN ORGANIZATION, WHO ARE NOT EXPERTS IN COMPUTER TECHNOLOGY, BUT WHO USE THE COMPUTER AS A TOOL TO ASSIST THEM IN THEIR WORK. (A, ABBR.)

COMMENTS:

THE AUTHORS CLASSIFY FORMS OF INTERACTION ACCORDING TO THE MEDIUM OF INTERACTION, THE MODE OF INTERACTION, AND USER SUPPORT AND CONSIDER THESE CATEGORIES AS THEY RELATE TO CLERICAL USERS, MANAGEMENT USERS, AND SPECIALIST USERS. A PRINCIPAL RESULT IS THAT SYSTEM DESIGNERS ARE PROVIDING INTERFACES THAT DO NOT ALLOW THE USER TO TAKE FULL ADVANTAGE OF THE COMPUTER FACILITIES. THIS IS DONE, HOWEVER, IN ORDER TO PROVIDE AN INTERFACE THAT IS SUFFICIENTLY SIMPLE FOR THE NAIVE USER TO USE. WHEN USERS REQUEST MORE POWERFUL FORMS OF INTERACTION, THEY MAY SUBSEQUENTLY FAIL TO USE THEM SINCE THE INTERFACE TENDS TO INCREASE IN COMPLEXITY. ALTHOUGH THE AUTHORS DO NOT OFFER A SOLUTION TO THIS PROBLEM, THEY DO INDICATE THREE AREAS THAT MUST BE CONSIDERED — THE INTERFACE, USER SUPPORT, AND INVOLVING THE USER IN SYSTEM DESIGN.

141 PERCEPTUAL FACTORS IN DISPLAYS

EASTERBY, R.S. THE PERCEPTION OF SYMBOLS FOR MACHINE DISPLAYS. ERGONOMICS, 1970, 13, 149-158.

DESCRIPTION:

THE ROLE OF PATTERN PERCEPTION THEORY BASED ON THE GESTALT VIEW OF PERCEPTION IS DISCUSSED IN RELATION TO THE PRACTICAL DESIGN OF SYMBOLS FOR MACHINE DISPLAYS. EXPERIMENTAL STUDIES OF DISCRIMINATION AND APPREHENSION OF MEANING OF SYMBOLS ARE REVIEWED, AND SOME RECOMMENDED PERCEPTUAL PRINCIPLES IMPORTANT TO SYMBOL DESIGN ARE SUMMARIZED. (A) 10P, 20R.

COMMENTS:

MANY OF THE THEORETICAL PRINCIPLES DISCOVERED IN BASIC PSYCHOLOGICAL RESEARCH COULD USEFULLY BE APPLIED TO THE DESIGN AND OPERATION OF COMPUTER SYSTEMS. THERE IS GENERALLY, HOWEVER, A LAG BETWEEN THE DISCOVERY OF USEFUL PRINCIPLES AND THEIR APPLICATION. ALTHOUGH SEVERAL FACTORS COULD ACCOUNT FOR THIS LAG, THE PRINCIPAL FACTOR APPEARS TO BE A DISPARITY IN TASK ENVIRONMENTS. THAT IS, IN BASIC RESEARCH SUBJECTS USE CERTAIN PROCESSES ON SPECIFIED TASKS AND IT IS FREQUENTLY DIFFICULT TO DETERMINE HOW THESE PROCESSES AND TASKS CORRESPOND TO THOSE INVOLVED IN COMPUTER SYSTEMS. SOME THEORETICAL PRINCIPLES, HOWEVER, ARE EASIER TO APPLY THAN OTHERS AND VISUAL PERCEPTION APPEARS TO BE SUCH AN AREA. HUMAN PERCEPTUAL PROCESSES ARE MORE OR LESS AUTOMATED AND THE FACTORS THAT AFFECT THESE PROCESSES ARE FAIRLY GENERAL. THIS PAPER ILLUSTRATES HOW BASIC PRINCIPLES OF PERCEPTION COULD BE APPLIED TO THE DESIGN OF SYMBOLIC DISPLAYS. THESE PRINCIPLES HAVE BEEN EXTENSIVELY DEMONSTRATED IN CONTROLLED SETTINGS AND THEIR APPLICATION TO DISPLAY DESIGN APPEARS TO BE STRAIGHTFORWARD. THE PRINCIPLES DESCRIBED IN THE PAPER, THOUGH VALID, DO NOT REFLECT THE CURRENT STATE OF RESEARCH IN HUMAN PERCEPTION. THE APPLICATION OF MORE RECENTLY DEVELOPED THEORETICAL PRINCIPLES SHOULD BE BOTH BENEFICIAL AND RELATIVELY EASY.

142 MAN-COMPUTER PROBLEM SOLVING
EDWARDS, J.S. ADAPTIVE MAN-MACHINE INTERACTION IN INFORMATION RETRIEVAL
(DOCTORAL DISSERTATION, UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA,
PENNSYLVANIA, 1967). (NTIS NO. PB 179802)
DESCRIPTION:

THREE SPECIFIC CONTRIBUTIONS TO THE FIELD OF INFORMATION RETRIEVAL ARE PRESENTED. THE FIRST TWO DESCRIBE THE ESTABLISHMENT OF AN ADAPTIVE, INTERACTIVE, MAN-MACHINE DIALOGUE THAT PRODUCES A FORM OF UNSOLICITED LIBRARIAN-LIKE ASSISTANCE FOR THE USER IN HIS SELECTION OF INDEX TERMS TO CHARACTERIZE AN INDEXING FUNCTION. THE DATA SET UPON WHICH THE SYSTEM RESTS IS PREPARED IN A SEMI-AUTOMATIC MANNER FROM PRESELECTED SAMPLES OF TEXT IN MACHINE READABLE FORM. THE FIRST CONTRIBUTION CONCERNS SETTING UP THIS DATA SET, THE SECOND DEALS WITH THE IMPLEMENTATION OF A MAN-MACHINE DIALOGUE. THE ALGORITHE THAT CONSTITUTES THE THIRD CONTRIBUTION EXTRACTS THE CYCLIC SETS OF TERMS FROM A SYMMETRIC RELATION TABLE. IT IS SHOWN HOW THIS TECHNIQUE HELPS THE FORMATION OF A CONSISTENT AND COMPLETE TABLE OF SYNONYMS. THE SYSTEM HAS BEEN IMPLEMENTED ON A PDP8-1040 COMPUTER COMPLEX AND IS PROGRAMMED FOR THE MOST PART IN L6-MAP. (A)

THE PRIMARY EMPHASIS OF THIS PAPER IS ON A TECHNIQUE FOR AUTOMATED DOCUMENT INDEXING. ALTHOUGH THE MAN-COMPUTER DIALOGUE DESCRIBED IS FAIRLY UNSOPHISTICATED BY TODAY'S STANDARDS, IT PROBABLY ACCURATELY REFLECTS THE THEN-CURRENT STATE OF THE ART IN INTERACTIVE SYSTEMS. THIS DIALOGUE DOES, HOWEVER, CONTAIN ONE USEFUL FEATURE. AFTER THE USER INPUTS HIS DESIRED INDEX TERMS, THE SYSTEM RESPONDS WITH A SET OF RELATED TERMS THAT MAY BE OF INTEREST. THE TERMS THAT ARE SUGGESTED ARE BASED ON THE SYSTEM'S PERCEPTION OF THE USER'S PRINCIPAL AREA OF INTEREST (E.G., HARDWARF OR SOFTWARE). THIS WOULD BE ESPECIALLY USEFUL WHEN THE USER IS UNFAMILIAR WITH THE INDEXING SYSTEM. ALTHOUGH THIS SYSTEM WORKS ONLY WITH SINGLE INDEX TERMS, AN AID TO ALLOW THE SPECIFICATION OF LOGICAL RELATIONS BETWEEN TERMS, SUCH AS THAT DESCRIBED BY D.U. WILDE (1969) SHOULD BE FAIRLY EASY TO INCORPORATE. THIS PAPER WOULD BE RELEVANT TO THOSE CONCERNED WITH INFORMATION RETRIEVAL SYSTEMS OR WITH DEVELOPING INDICES FOR LARGE DATA BASES.

143 GEMERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
EDWARDS, W. MEN AND COMPUTERS. IN R.M. GAGNE & A.W. MELTON (EDS.),
PSYCHOLOGICAL PRINCIPLES IN SYSTEM DEVELOPMENT. NEW YORK: HOLT, RINEHART AND
JINSTON, 1962, 75-113.
DESCRIPTION:

HOW SHOULD COMPUTERS BE USED? HOM SHOULD FUNCTIONS BE ALLOCATED BETWEEN COMPUTERS AND MEN? WHAT KINDS OF INTERCOMMUNICATION DEVICES AND TECHNIQUES ARE MOST EFFECTIVE? THIS PAPER EXAMINES THESE QUESTIONS. IT BEGINS WITH AN EXPOSITORY DISCUSSION OF COMPUTERS AND COMPUTATION. IT THEN COMPARES MEN AND COMPUTERS WITH AN EYE TO FUNCTION ALLOCATION WITHIN LARGE SYSTEMS. IT NEXT DISCUSSES THE NATURE OF HUMAN JOBS IN SYSTEMS WHICH INCLUDE COMPUTERS. IT CONCLUDES WITH A DISCUSSION OF COMPUTERS AS MODELS FOR MAN AND OF THE ARTIFICIAL INTELLIGENCE PROBLEM. (A, ABBR.) 39P, 44R.

COMMENTS:
THIS PAPER PRESENTS A BROAD, EASY TO READ INTRODUCTION TO THE AREAS LISTED IN THE ABSTRACT. THE DISCUSSIONS ARE NON-TECKNICAL AND PROVIDE FAIRLY CLEAR DESCRIPTIONS OF THE PRINCIPAL CONCEPTS INVOLVED IN THESE AREAS. ALTHOUGH SOME ASPECTS OF THOSE DISCUSSIONS ARE DATED, THIS PAPER LOULD BE USEFUL AS AN INTRODUCTION TO COMPUTER SYSTEM USES AND MAN-COMPUTER INTERACTION.

144 SYMBOLIC CODING USING ALPHANUMERIC AND GEOMETRIC SYMBOLS
ELLIS, K., & KITSON, A. EXPERIMENTS ON SYMBOLOGIES FOR A.D.A. SYSTEMS
(REPORT NO. ARL/APU/R2). TEDDINGTON, MIDDLESEX, ENGLAND: ADMIRALTY RESEARCH
LABORATORY, APPLIED PSYCHOLOGY UNIT, JULY 1970. (NTIS NO. AD 717213)
DFSCRIPTION:

EIGHT VARIANTS OF 2 MAIN TYPES OF SYMBOLOGY, ALPHA-NUMERIC AND GEOMETRIC, FOR USE WITH COMPUTER-GENERATED CRT DISPLAYS WERE INVESTIGATED IN TWO EXPERIMENTS. THE FIRST EXPERIMENT COMPARED THE EFFICIENCY OF THE DIFFERENT SYMBOLOGIES IN CARRYING OUT A FAIRLY REPRESENTATIVE TASK, I.E., DISTINGUISHING BETWEEN "FRIENDLY" AND "HOSTILE" CONTACTS. THE SECOND EXPERIMENT COMPARED THE SAME SYMBOLOGIES, BUT THIS TIME IN TERMS OF THE DIFFICULTIES FOUND IN VIEWING THE CHARACTERS IN DIFFERENT ORIENTATIONS (E.G., UPSIDE DOWN). SUCH A SITUATION IS TO BE FOUND USING THE LATEST HORIZONTAL "CONFERENCE" DISPLAYS.

THE RESULTS OF THESE EXPERIMENTS INDICATE THE IMPORTANCE OF DEFINING WHAT TASKS ARE TO BE CARRIED OUT WHEN SELECTING SYMBOLOGIES SINCE DIFFERENT SYMBOLOGIES WERE SUPERIOR IN TERMS OF SPEED AND ACCURACY OF RESPONSE FOR DIFFERENT TYPES OF TASKS. THE EFFECT OF VIEWING THE DISPLAY FROM NON-PREFERRED ANGLES HAD A NEGLIGIBLE EFFECT ON PERFORMANCE WITH ONE EXCEPTION. THIS OCCURRED WHEN AMBIGUOUS GEOMETRIC SYMBOLS WERE USED. (A) 23P, DR.

COMMENTS:

THE CHARACTER SETS USED IN THESE EXPERIMENTS VARIED WITH RESPECT TO LENGTH, THE ADDITION OF IRRELEVANT NUMERIC CHARACTERS, AND THE ADDITION OF ALPHA CHARACTERS TO GEOMETRIC SYMBOLS, AS WELL AS WITH RESPECT TO BEING PREDOMINATELY GEOMETRIC OR ALPHANUMERIC. THE DIFFICULTY IN CLASSIFYING THESE SYMBOLOGIES ALONG WELL-DEFINED DIMENSIONS, AS WELL AS PROCEDURAL PROBLEMS SUCH AS FAILURE TO COUNTER-BALANCE THE PRESENTATION ORDER OF SYMBOLOGIES MAKE IT VERY DIFFICULT TO INTERPRET THE RESULTS OF THESE EXPERIMENTS AND NO STATISTICAL ANALYSES ARE REPORTED. ALTHOUGH THIS PAPER ADDRESSES A REAL PROBLEM AND THERE MAY BE SOME USEFUL INFORMATION HERE, THE READER WOULD FIND IT VERY DIFFICULT TO EXTRACT THAT INFORMATION.

145 INTERACTIVE GRAPHICS USING RAND TABLET ELLIS, T.O., HEAFNER, J.F., & SIBLEY, W.L. INTERACTIVE MAN-MACHINE COMMUNICATIONS. INSTRUMENTS AND CONTROL SYSTEMS, JANUARY 1971, 44(1), 92-94. DESCRIPTION:

COMPUTER DEVELOPMENT HAS BEEN ACCOMPANIED BY THE INTRODUCTION OF VERSATILE DEVICES FOR MAN-MACHINE COMMUNICATIONS. FOR EXAMPLE, CRT DISPLAYS ARE NOW COMMONLY USED TO PRESENT LARGE QUANTITIES OF INFORMATION TO AN OPERATOR, IN EASILY COMPREHENDED FORM. IN MANY SYSTEMS, A KEYBOARD PROVIDES THE MEANS FOR OPERATOR INPUT. HOWEVER, IF DATA ARE PRESENTED GRAPHICALLY, AN INPUT MAY BE DESIRED WHICH ALLOWS AN OPERATOR TO EXPRESS HIMSELF DIRECTLY ON A TWO-DIMENSIONAL SURFACE. WITH SUCH A SYSTEM, THE CRT FACE CAN BECOME THE COMMON WORKING PLACE FOR BOTH MAN AND MACHINE. (A)

3P, 5R.

THIS IS A VERY BRIEF DESCRIPTION OF AN INTERACTIVE SYSTEM THAT INVOLVES A CRT AND A RAND TABLET AND AN INTERACTIVE LANGUAGE, GRAIL (GRAPHICAL INPUT LANGUAGE), THAT IS USED WITH THIS SYSTEM. ALTHOUGH THE PRIMARY EMPHASIS IN ON THE FUNCTIONAL PROPERTIES OF THIS SYSTEM, HARDWARE AND SOFTWARE PROBLEMS ARE CONSIDERED BRIEFLY. THIS PAPER PROVIDES A LOW-LEVEL INTRODUCTION TO THE DESIGN AND CAPABILITIES OF THE RAND TABLET AND TO THE RATIONALE UNDERLYING ITS DEVELOPMENT.

146 PROGRAMMING BY NON-COMPUTER SPECIALISTS

ENGEL, F., JR. FORTRAN EXPERIENCE AND REMOTE OPERATION BY NON-COMPUTER SPECIALISTS. IN PROCEEDINGS OF THE 1959 COMPUTER APPLICATIONS SYMPOSIUM. CHICAGO, ILLINOIS: ARMOUR RESEARCH FOUNDATION OF THE ILLINOIS INSTITUTE OF TECHNOLOGY, 1960, 132-142.

DESCRIPTION:

THIS PAPER REVIEWS EXPERIENCES IN USING FORTRAN ON A 1BM 704 COMPUTER, PARTICULARLY WITH RESPECT TO ITS USE BY NON-COMPUTER SPECIALISTS. THE TRAINING MATERIALS USED, THE ROLE OF THE INTERMEDIARY WHO SERVED AS A BUFFER BETWEEN THE USER AND THE COMPUTER, AND USER'S REACTIONS ARE CONSIDERED.

COMMENTS:

ALTHOUGH THIS PAPER IS SERIOUSLY DATED, IT PROVIDES AN INTERESTING DESCRIPTION OF THE USE OF AN EARLY COMPUTER SYSTEM. IT IS INTERESTING TO NOTE, FOR EXAMPLE, THAT THE REQUIREMENT FOR AN EFFECTIVE INTERFACE BETWEEN THE USER AND THE COMPUTER WAS RECOGNIZED, BUT THE SOLUTION WAS TO PROVIDE A HUMAN INTERMEDIARY SO THAT THE USER WAS BOTH PHYSICALLY AND LOGICALLY REMOVED FROM THE COMPUTER SYSTEM AND ITS OPERATION.

147 GUIDELINES FOR MAN-COMPUTER DIALOGUE

ENGEL, S.E., & GRANDA, R.E. GUIDELIMES FOR MAN/DISPLAY INTERFACES (TECHNICAL REPORT TR DO.2720). POUGHKEEPSIE, NEW YORK: IBM POUGHKEEPSIE LABORATORY, DECEMBER 1975.

DESCRIPTION:

THIS REPORT DOCUMENTS A SET OF HUMAN FACTORS GUIDELINES RELATING TO THE INTERFACE BETWEEN A USER OF AN INTERACTIVE COMPUTING SYSTEM AND A DISPLAY TERMINAL CONNECTED TO THE SYSTEM. THOUGH INTENDED PRIMARILY FOR THE USE OF DEVELOPERS OF SOFTWARE FOR AN INTERACTIVE SYSTEM, MANY OF THE GUIDELINES SHOULD BE OF INTEREST TO HARDWARE DEVELOPERS. AREAS COVERED INCLUDE DISPLAY FRAME LAYOUT, FRAME CONTENT, COMMAND LANGUAGES, ERROR PREWENTION AND RECOVERY, RESPONSE TIMES, AND BEHAVIORAL PRINCIPLES. (A) 42P, 32R.

COMMENTS:

THIS IS AN EXCELLENT SET OF GENERAL GUIDELINES FOR DESIGNERS OF INTERACTIVE SOFTWARE AND, TO A LESSER EXTENT, HARDWARE. ALTHOUGH SPECIFIC RESEARCH PAPERS ARE NOT REFERENCED BY THIS DOCUMENT, ITS GUIDELINES ARE GENERALLY SUPPORTED BY, OR AT LEAST CONSISTENT WITH, OUR UNDERSTANDING OF MANCOMPUTER INTERACTION AS DERIVED FROM EMPIRICAL STUDIES AND RELEVANT PSYCHOLOGICAL THEORY. WHILE A FEW OF THE AUTHORS' CONCLUSIONS ARE SOMEWHAT CONTROVERSIAL (E.G., THE JOYSTICK IS THE "BEST" CURSOR CONTROL DEVICE), THEY ARE OVERALL WELL REASONED AND SUFFICIENTLY WELL EXPLAINED TO ALLOW THE GUIDELINES TO BE USED IN A THOUGHTFUL, INFORMED FASHION. THE AUTHORS HAVE GOTTEN A GOOD DEAL OF INFORMATION INTO A RELATIVELY SHORT, EASILY READABLE FORM.

148 TERMINAL PROPERTIES, WITH EMPHASIS ON INPUT DEVICES
ENGELBART, D.C. DESIGN CONSIDERATIONS FOR KNOWLEDGE WORKSHOP TERMINALS. AFIPS
CONFERENCE PROCEEDINGS, 1973, 42, 221-227.
DESCRIPTION:

THIS PAPER DESCRIBES CURRENT DEVELOPMENTS OF THE STANFORD RESEARCH INSTITUTE AUGMENTATION RESEARCH CENTER (SRI-ARC) IN INTERACTIVE DISPLAY SERVICES. USAGE AND LEARNABILITY ARE CONSIDERED FOR A MOUSE, KEYSETS AND KEYBOARDS. CONSIDERATIONS ABOUT THE DISTRIBUTION OF FUNCTIONS BETWEEN TERMINAL AND REMOTE SHARED RESOURCES ARE PRESENTED AND FUTURE NEEDS ARE DISCUSSED. AN ANNOTATED BIBLIOGRAPHY DESCRIBES RELATED WORK AT SRI-ARC. 7P, 19R.

COMMENTS:

THIS PAPER BRIEFLY DESCRIBES SOME OF THE AUTHOR'S DBSERVATIONS ON THE DEVELOPMENT OF THE AUGMENTATION RESEARCH CENTER AT STANFORD RESEARCH INSTITUTE. THE AUTHOR INTRODUCES THE CONCEPT OF THE "USER-SYSTEM, SERVICE-SYSTEM DICHOTOMY" WITH THE TERMINAL AS AN INTERFACE BETWEEN THESE TWO "SYSTEMS" AND ARGUES THAT THOSE WHO DEVELOP THE SERVICE SYSTEM ON THE MECHANICAL SIDE OF THE TERMINAL SHOULD GIVE GREATER CONSIDERATION TO THE USER SYSTEM ON THE HUMAN SIDE OF THE INTERFACE. THE SPECIFIC DEVICES CONSIDERED IN THIS PAPER ARE THE MOUSE AND THE ONE-HANDED, CHORDED KEYSET, AND THE AUTHOR INFORMALLY DESCRIBES THE CONSIDERATIONS INVOLVED IN THE DEVELOPMENT OF THESE DEVICES. ALTHOUGH THIS PAPER DOES NOT PROVIDE DETAILED DESCRIPTIONS OF TERMINAL DEVICES OR OF EMPIRICAL TESTS OF THESE DEVICES, IT DOES PROVIDE A FAIRLY GOOD, GENERAL INTRODUCTION TO THE TYPE OF WORK BEING DONE AT THE AUGMENTATION RESEARCH CENTER. AN ANNOTATED BIBLIOGRAPHY OF RELATED PAPERS IS ALSO INCLUDED.

149 GRAPHICAL INPUT DEVICES
ENGLISH, W.K., ENGELBART, D.C., & BERMAN, M.L. DISPLAY-SELECTION TECHNIQUES FOR
TEXT MANIPULATION. IRE TRANSACTIONS ON HUMAN FACTORS IN ELECTRONICS, 1967,
HFE-8, 5-15.

DESCRIPTION:

TESTS AND ANALYSIS TO DETERMINE THE BEST DISPLAY-SELECTION TECHNIQUES FOR A COMPUTER-AIDED TEXT-MANIPULATION SYSTEM REVEAL THAT THE CHOICE DOES NOT HINGE ON THE INHERENT DIFFERENCES IN TARGET-SELECTION SPEED AND ACCURACY BETWEEN THE DIFFERENT SELECTION DEVICES. OF MORE IMPORTANCE ARE SUCH FACTORS AS THE MIX OF OTHER OPERATIONS REQUIRED OF THE SELECT-OPERATION HAND, THE EASE OF GETTING THE HAND TO AND GAINING CONTROL OF A GIVEN SELECTION DEVICE, OR THE FATIGUE EFFECTS OF ITS ASSOCIATED OPERATING POSTURE.

BESIDES A LIGHT-PEN, SEVERAL CURSOR-CONTROLLING DEVICES WERE TESTED, INCLUDING A JOYSTICK AND AN SRI-DEVELOPED DEVICE KNOWN AS A "MOUSE". THE STUDY WAS AIMED DIRECTLY AT FINDING THE BEST DISPLAY-SELECTION MEANS FOR OUR TEXT MANIPULATION SYSTEM, BUT GENERALIZATIONS APPLICABLE TO OTHER TYPES OF ON-LINE SYSTEMS WERE DERIVED. (A)

11P, 6R. COMMENTS:

THIS EXPERIMENT COMPARED SEVERAL INPUT DEVICES IN THE CONTEXT OF SELECTING A SINGLE CHARACTER OR SELECTING A SINGLE WORD. EXPERIENCED SUBJECTS WERE OBSERVED TO PERFORM BEST WITH THE SRI "MOUSE", ESPECIALLY IN TERMS OF ERRORS IN THE CHARACTER MODE. SPEED WAS ABOUT THE SAME FOR MOUSE, LIGHTPEN, AND GRAFACON TABLET. INEXPERIENCED SUBJECTS ALSO HAD FEWEST ERRORS WITH THE MOUSE (THEY DID ONLY THE CHARACTER SELECTION TASK), BUT PERFORMED SLIGHTLY MORE RAPIDLY WITH THE KNEE CONTROL AND LIGHTPEN. THE JOYSTICK WAS FOUND TO BE BOTH SLOWER AND MORE ERROR PRONE THAN OTHER DEVICES. SEVERAL THINGS MUST BE CONSIDERED WHEN INTERPRETING THESE RESULTS, HOWEVER. FIRST, THE AUTHORS ARE AWARE OF SEVERAL HARDWARE AND SOFTWARE PROBLEMS WHICH MIGHT HAVE CAUSED POORER-THAN-OPTIMAL PERFORMANCE WITH THE JOYSTICK AND THE LIGHTPEN. SECOND, THE TASK INVOLVED DEPRESSION OF THE KEYBOARD SPACE BAR AFTER TARGET PRESENTATION AND BEFORE OPERATION OF THE POSITION INPUT DEVICE. WHILE THIS PROBABLY HAD LITTLE INFLUENCE ON PERFORMANCE WITH THE KNEE CONTROL, IT UNDOUBTEDLY AFFECTED PERFORMANCE WITH OTHER DEVICES. IN PARTICULAR, IT MAY HAVE DEGRADED PERFORMANCE WITH THE LIGHTPEN. THUS, THESE AUTHORS HAVE SIMULATED A TASK INVOLVING MIXED INPUT MODES, AS IN TYPING FOLLOWED BY A GRAPHICAL POSITION INPUT. If SEVERAL INPUTS ARE MADE IN SUCCESSION USING THE POSITION INPUT DEVICE, AS IN CONSTRUCTING A COMMAND BY MENU SELECTION, THE RESULTS MIGHT BE QUITE DIFFERENT, AND THIS EXPERIMENTAL RESULT SHOULD NOT BE EXPECTED TO APPLY TO SUCH TASKS.

150 INPUT DEVICES, TEXT PROCESSING

ENGLISH, W.K., ENGELBART, P.C., & HUDDART, B. COMPUTER-AIDED DISPLAY CONTROL (FINAL REPORT, CONTRACT NAS1-3988). MENLO PARK, CALIFORNIA: STANFORD RESEARCH INSTITUTE, JULY 1965. (NASA NO. CR-66111, NTIS NO. N66-30204) DESCRIPTION:

THIS REPORT PRESENTS THE INITIAL RESULTS OF A CONTINUING RESEARCH STUDY ON THE COMPUTER-AIDED HUMAN CONTROL OF COMPUTER DISPLAYS. SPECIFICALLY, THIS PROJECT HAS BEEN CONCERNED WITH EXPLORING METHODS OF IMPROVING A PERSON'S ABILITY TO COMPOSE AND MODIFY TEXT PRESENTED ON A COMPUTER-DRIVEN CATHODE RAY TUBE DISPLAY.

THIS REPORT INCLUDES A (FAIRLY DETAILED) DESCRIPTION OF THE ON-LINE SYSTEM FOR TEXT MANIPULATION, DEVELOPED IN PART BY THIS PROJECT. AN APPROACH TO THE ANALYSIS AND EVALUATION OF TECHNIQUES FOR THE CONTROL OF COMPUTER DISPLAYS IS DEVELOPED AND THE RESULTS OF SOME PRELIMINARY EVALUATIVE EXPERIMENTS ARE DESCRIBED.

THE EXPERIMENTS COMPARED LIGHTPEN, JOYSTICK, "MOUSE", GRAFACON TABLET, AND KNEE CONTROLS FOR SELECTION OF RANDOMLY PLACED CHARACTER OR WHOLE-WORD OPERANDS VIA POSITIONING OF A CURSOR. FOR EXPERIENCED SUBJECTS, THE MOUSE WAS FASTER AND MORE ACCURATE THAN OTHER MODES. INEXPERIENCED SUBJECTS WERE MOST ACCURATE WITH THE MOUSE, FASTER WITH THE KNEE CONTROL. (A & HRR) 112P, 55R.

COMMENTS:

IN ORDER TO BE ABLE TO COMPARE ALTERNATIVE TECHNIQUES AND DEVICES FOR MAN-COMPUTER INTERFACES, IT IS NECESSARY TO DEFINE THE APPROPRIATE MEASUREMENT TECHNIQUES. THIS PAPER ADDRESSES THIS QUESTION IN TERMS OF AN ON-LINE TEXT MANIPULATION SYSTEM. THE PROPOSED METHOD DECOMPOSES THE PROCESSES THAT THE HUMAN OPERATOR MUST PERFORM INTO A SET OF "PRIMITIVE" PROCESSES. THE COMPLETE INTERACTION CAN BE DEFINED IN TERMS OF THE INTERRELATIONS BETWEEN THESE PRIMITIVE PROCESSES. THIS AIDS IN MEASURING, DESCRIBING, AND ANALYZING INTERACTIONS AS WELL AS SUGGESTING AREAS WHERE THE GREATEST IMPROVEMENTS CAN BE MADE. ALTHOUGH THE PROCESS DESCRIPTIONS PRESENTED HERE ARE SOMEWHAT SPECIFIC TO THE SYSTEM UNDER CONSIDERATION, SIMILAR DESCRIPTIONS COULD BE USEFULLY APPLIED TO A VARIETY OF SITUATIONS. THE FINAL SECTION OF THIS PAPER DESCRIBES AN EMPIRICAL EVALUATION OF INPUT DEVICES, BASED IN PART, ON THESE PROCESS DESCRIPTIONS. THE READER INTERESTED IN THIS EXPERIMENT IS REFERRED TO W.K. ENGLISH, D.C. ENGELBART, AND M.L. BERMAN (1967).

151 USER ACCEPTANCE OF MEDICAL INTERVIEW SYSTEM EVANS, C.R. WHAT I HAVE LEARNT ABOUT COMPUTER COMMUNICATION AND WHAT COMPUTERS HAVE TAUGHT ME ABOUT HUMAN COMMUNICATION. PAPER PRESENTED AT NATO ADVANCED STUDY INSTITUTE ON MAN-COMPUTER INTERACTION, MATI, GREECE, SEPTEMBER 1976 (REPRINTED BY COMPUTER SCIENCE DIVISION, NATIONAL PHYSICAL LABORATORY, TEDDINGTON, MIDDLESEX, ENGLAND).
DESCRIPTION:

THE AUTHOR OF THIS PAPER EXPRESSES CONCERN AT THE LACK OF REAL PROGRESS IN RESEARCH ON THE PSYCHOLOGY OF MAN-COMPUTER INTERACTION AND DISCUSSES SOME OF THE CAUSES. HE THEN PRESENTS A NUMBER OF OBSERVATIONS FROM HIS DEVELOPMENT WORK ON AN AUTOMATED-MEDICAL-HISTORY-INTERVIEW SYSTEM, SOME OF WHICK MAY CONTRADICT EXISTING LORE. IN DEVELOPING THE SYSTEM, HE FOUND THAT THE INTERVIEWS WERE LOGICALLY SIMPLE AND REQUIRED ONLY SIMPLE RESPONSES FROM THE PATIENTS, THAT SLOW (10 CPS), NOISY (TELETYPE) TERMINALS WERE ACTUALLY PREFERRED TO FASTER CRT DISPLAYS, AND THAT PATIENTS LEARNED AND USED THE SYSTEM VERY EASILY, EVEN (PERHAPS ESPECIALLY) FOR INTERVIEWS IN SENSITIVE AREAS. HE ALSO REPORTS VERY SUCCESSFUL RESULTS WITH A DIALOGUE CONTROLLER WHICH PROVIDES A SURFACE-ONLY EMULATION OF NATURAL LANGUAGE.

## COMMENTS:

THIS IS AN INFORMAL "TALKING" PAPER WHICH BRIEFLY ALLUDES TO A NUMBER OF RESULTS WITHOUT DISCUSSING EXPERIMENTAL PROCEDURES OR OTHERWISE QUALIFYING THE RESULTS AS MORE THAN SUBJECTIVE IMPRESSIONS. THE AUTHOR'S BASIC CONCLUSION IS THAT NAIVE USERS ARE SMARTER AND MORE ACCEPTING OF COMPUTER SYSTEMS THAN WE GENERALLY GIVE THEM CREDIT FOR, SO LONG AS THE SYSTEMS ARE WELL DESIGNED. WHILE THE AUTHOR'S OBSERVATIONS ARE CONVINCINGLY DISCUSSED AND GENERALLY BELIEVABLE, HE FAILS TO POINT OUT A POTENTIAL SOURCE OF BIAS. IN THE UNITED STATES, AT LEAST, INDIVIDUALS TEND TO BEHAVE IN A MUCH MORE PASSIVE, SUBMISSIVE MANNER WHEN IN THE ROLE OF MEDICAL PATIENT THAN IN OTHER ROLES, WHILE THE HOSPITAL-CLINIC ENVIRONMENT IS SOMEWHAT AUTHORITARIAN. IT MAY BE, THEREFORE, THAT EASY ACCEPTANCE OF COMPUTER SYSTEMS BY USERS IN THIS ENVIRONMENT DOES NOT GENERALIZE TO ENVIRONMENTS IN WHICH THEY ADOPT OTHER, MORE ASSERTIVE ROLES.

USER REQUIREMENTS ANALYSIS
EVANS, J.A. A METHODOLOGY FOR COMMAND INFORMATION SYSTEM ANALYSIS. IN D.E.
AALKER (ED.), INFORMATION SYSTEM SCIENCE AND TECHNOLOGY: PAPERS PREPARED FOR
THE THIRD CONGRESS. WASHINGTON, D.C.: THOMPSON, 1967, 251-270.
DESCRIPTION:

IN DESIGNING COMPUTERIZED SUPPORT SYSTEMS FOR COMMAND INFORMATION SYSTEMS, A COMPLEX DILEMMA EXISTS BETWEEN THO COMMUNITIES: THE USER, WHO IS OPERATIONS-ORIENTED, AND THE DESIGNER, WHO IS TECHNOLOGY-ORIENTED. THE PRIMARY REASON FOR THIS DILEMMA IS A LACK OF UNDERSTANDING OF WHAT A COMMAND INFORMATION SYSTEM IS AND DOES, AND WHY. IN AN EFFORT TO SOLVE THIS PROBLEM, A METHODOLOGY IS PROPOSED FOR ANALYZING COMMAND INFORMATION SYSTEMS, AND THUS, AIDING THE DESIGNER IN DEVELOPING MORE EFFECTIVE SYSTEMS. THIS METHODOLOGY PRODUCES FOUR MAJOR PRODUCTS: (1) AN OPERATIONAL ENVIRONMENT SUMMARY THAT PROVIDES A BASIC UNDERSTANDING OF THE OPERATIONAL ENVIRONMENT, (2) A FUNCTION EXECUTION SUMMARY THAT DESCRIBES HOW MAJOR COMMAND FUNCTIONS ARE EXECUTED, (3) AN INTEGRATED FUNCTIONAL SUMMARY THAT DETAILS THE INTERACTIONS OF THESE FUNCTIONS, AND (4) A COMMAND ANALYSIS SUMMARY THAT UPDATES AND SUMMARIZES SYSTEM ANALYSIS EFFORTS. THIS METHODOLOGY IS INTENDED TO ASSIST IN DEVELOPING A COMPREHENSIVE UNDERSTANDING OF THE COMMAND AND CONTROL STRUCTURE AS IT RELATES TO THE INFORMATION SYSTEM NETWORK.

COMMENTS:

THE AUTHOR MAKES A FAIRLY STRONG CASE FOR THE EXISTENCE OF A "REQUIREMENTS TRANSLATION GAP" THAT RESULTS IN VAGUELY SPECIFIED SYSTEM REQUIREMENTS AND THE ADOPTION OF DESIGN CRITERIA THAT OFTEN PROVE TO BE INADEQUATE. AS THE AUTHOR NOTES, THE PROPOSED METHOD IS MORE OF A GUIDE THAN A STEP-BY-STEP MANUAL FOR REQUIREMENTS ANALYSIS AND THE APPLICATION OF THESE GUIDELINES REQUIRES A GREAT DEAL OF JUDGMENT AND EXPERIENCE. THIS METHODOLOGY DGES, HOWEVER, LEAD TO THE IDENTIFICATION OF PROBLEM AREAS THAT SHOULD BE ADDRESSED BY THE DESIGNER AND COULD, THEREFORE, BE QUITE USEFUL.

MANAGEMENT INFORMATION SYSTEMS
FEDERICO, P.-A., BRUN, K.E., & MCCALLA, D.B. COMPUTER-BASED MANAGEMENT
INFORMATION SYSTEMS: IS THERE REALLY AN "INFORMATION GLUT"? IN PROCEEDINGS,
HUMAN FACTORS SOCIETY, 19TH ANNUAL MEETING. SANTA MONICA, CALIFORNIA:
HUMAN FACTORS SOCIETY, 1975, 150-153.

DESCRIPTION:

SOME SALIENT ISSUES ARE IDENTIFIED AND DISCUSSED CONCERNING COMPUTER-BASED MANAGEMENT INFORMATION AND DECISION SYSTEMS AND MANAGERIAL BEHAVIOR. THE LITERATURE IN THIS AREA IS VERY INCONSISTENT AND UNCERTAIN WITH RESPECT TO THE ALLEGED IMPACT OF THESE AUTOMATED SYSTEMS UPON MANAGERIAL INFORMATION PROCESSING AND DECISION MAKING. THIS UNDERSCORES THE ALMOST COMPLETE ABSENCE OF EMPIRICAL DATA REGARDING THE IMPLICATIONS OF THESE SYSTEMS FOR MANAGERIAL BEHAVIOR. RESEARCH SHOULD BE INITIATED TO EXPLORE EMPIRICALLY WHAT THE IMPACTS OF COMPUTERIZED INFORMATION SYSTEMS ARE FOR MANAGEMENT.

(A)

# 4P, 1R.

THE AUTHORS ARE QUITE CORRECT IN ARGUING THAT RESEARCH ON MANAGEMENT INFORMATION SYSTEMS IS NEEDED. THIS IS ALSO TRUE, HOWEVER, FOR ALL TYPES OF MAN-COMPUTER INTERACTION. ONE UNDERLYING REASON IS THAT SYSTEMS ARE DESIGNED AND IMPLEMENTED WITHOUT A THOROUGH UNDERSTANDING OF WHAT FUNCTIONS THE SYSTEM SHOULD PERFORM OR HOW THE USER WILL INTERFACE WITH THE SYSTEM. THE AUTHORS ARE ALSO CORRECT IN NOTING THAT THE LITERATURE ON MANAGEMENT INFORMATION SYSTEMS IS FILLED WITH CONTRADICTORY FORECASTS OF THE IMPLICATIONS OF MANAGEMENT INFORMATION SYSTEMS. FORECASTS BASED ON AN INDIVIDUAL'S INTUITIONS OR PERSONAL PHILOSOPHY ARE, OF COURSE, NOT AN ADEQUATE SUBSTITUTE FOR CONTROLLED RESEARCH.

154 COMPARISON OF CRT AND TELETYPE TERMINALS
FETTER, R.B., & CARLISLE, J.H. MAN-COMPUTER INTERACTION IN A DECISION-MAKING
ENVIRONMENT (REPORT NO. 1). NEW HAVEN, CONNECTICUT: YALE UNIVERSITY,
DEPARTMENT OF ADMINISTRATIVE SCIENCES, MARCH 1971. (NTIS NO. AD 722336)
DESCRIPTION:

AN EXPERIMENT WAS PERFORMED TO COMPARE VIDEO AND TELETYPE CONSOLES IN AN INFORMATION RETRIEVAL ENVIRONMENT. SUBJECTS REQUIRED MORE TIME TO COMPLETE A SEARCH TASK WITH A VIDEO DISPLAY, MADE MORE ERRORS, AND RETRIEVED SLIGHTLY MORE RELEVANT INFORMATION. A METALANGUAGE DESCRIPTION OF AN INFORMATION RETRIEVAL SYSTEM IS PRESENTED ALONG WITH A BIBLIOGRAPHY OF RESEARCH IN MAN—COMPUTER INTERACTION, 56P, 123R.

COMMENTS:

THE EXPERIMENT REPORTED IN THIS PAPER COMPARED TELETYPE AND CRT TERMINALS IN THE CONTEXT OF RETRIEVAL OF INFORMATION ABOUT PAST LAW CASES RELEVANT TO A PARTICULAR ISSUE. THE RESULTS ARE PROBABLY NOT GENERALIZABLE, SINCE THE CRT TERMINAL USED WAS KNOWN TO BE POOR BY MODERN STANDARDS. THE EXPERIMENTAL METHOD IS INTERESTING, HOWEVER. IT INVOLVED THE USE OF DISCRIMINANT ANALYSIS TO DETERMINE THE NATURE OF THE PERFORMANCE DIFFERENCES BETWEEN THE TWO EXPERIMENTAL GROUPS. THIS STATISTICAL TECHNIQUE ALLOWS SIMULTANEOUS CONSIDERATION OF PERFORMANCE DIFFERENCES ON SEVERAL VARIABLES. PERFORMANCE EFFECTS NEED NOT BE IN THE SAME DIRECTION ON DIFFERENT VARIABLES, AND MEED NOT BE INDEPENDENT. THIS APPEARS TO BE A GOOD TECHNIQUE FOR EXPLORING SITUATIONS IN WHICH TWO CONDITIONS (DIFFERENT TERMINALS, ETC.) HAVE RELATIVE ADVANTAGES AND DISADVANTAGES ON SEVERAL PERFORMANCE FACTORS. THE DISCRIMINANT ANALYSIS IS USED BOTH TO DETERMINE OVERALL PERFORMANCE DIFFERENCES AND TO IDENTIFY THOSE PERFORMANCE FACTORS MOST AFFECTED. THE TECHNIQUE IS CLEARLY EXPLAINED AND COULD BE USED IN A VARIETY OF EMPIRICAL STUDIES. THE PAPER IS RELEVANT TO THOSE INTERESTED IN MAN-COMPUTER INTERACTION IN GENERAL, AND IT CONTAINS SOME USEFUL IDEAS FOR THOSE PLANNING RESEARCH IN THIS AREA.

155 TRANSITION DIAGRAMS FOR DIALOGUE CONTROL FEYOCK, S. TRANSITION DIAGRAM-BASED CAI/HELP SYSTEMS. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1977, 9, 399-413.
DESCRIPTION:

THE CREATION OF CAI MATERIAL IS GENERALLY A FORMIDABLE TASK, SINCE ALL POSSIBLE BRANCHING PATHS, CORRESPONDING TO ALL POSSIBLE USER INPUTS BOTH CORRECT AND INCORRECT, MUST BE ANTICIPATED AND RECEIVE AN APPROPRIATE RESPONSE. A SYSTEM WHICH CAN BE GIVEN ONLY THE SET OF CORRECT PATHS THROUGH THE MATERIAL AND WHICH CAN AUTOMATICALLY GENERATE APPROPRIATE RESPONSES TO USER ERRORS AND REQUESTS FOR ASSISTANCE WOULD GREATLY SIMPLIFY THIS TASK. WE HAVE FOUND THAT IF THE MATERIAL TO BE PRESENTED CAN BE REPRESENTED AS A TRANSITION DIAGRAM, THEN MUCH OF THE PROCESS OF PROVIDING ERROR FEEDBACK AND ASSISTANCE CAN BE AUTOMATED. IN ADDITION, TRANSITION DIAGRAMS HAVE BEEN FOUND CAPABLE OF MODELING A WIDE ENOUGH CLASS OF CONCEPTS TO BE USEFUL FOR MANY APPLICATIONS. (A)

COMMENTS:

TRANSITION DIAGRAMS ARE A USEFUL FORMALISM FOR REPRESENTING ALGORITHMS OR OTHER PROCEDURAL CONCEPTS. THE TRANSITION DIAGRAM FORMULATION ALSO ALLOWS A PROCESS TO BE SIMULTANEOUSLY REPRESENTED BOTH AS A PROGRAM ITSELF AND AS A MODEL OF THAT PROGRAM. IN EFFECT, THIS ALLOWS A PROGRAM TO EXPLAIN, OR ANSWER QUESTIONS ABOUT, ITS OPERATION. THIS SHOULD AID THE DEVELOPMENT OF SYSTEMS WITH EMBEDDED TRAINING CAPABILITIES, AS WELL AS MORE GENERAL AND FLEXIBLE DIALOGUE CONTROL. VERY SIMILAR FORMALISMS, AUGMENTED TRANSITION NETWORKS, HAVE BEEN USED EXTENSIVELY AND FAIRLY SUCCESSFULLY IN ARTIFICIAL INTELLIGENCE RESEARCH ON PARSING NATURAL AND COMPUTER LANGUAGES. TRANSITION DIAGRAMS, LIKE PETRI NETS (SEE J.A. MELDMAN, 1977), MAY ALSO PROVE USEFUL IN MODELING INTERACTIVE SYSTEMS AND PROVIDING INSIGHTS INTO MAN-COMPUTER INTERACTIONS. THIS ISSUE, HOWEVER, IS NOT DIRECTLY ADDRESSED IN THIS PAPER.

156 INFORMATION PROCESSING LOAD IMPOSED BY SYSTEM ON USER FINKELMAN, J.M. INFORMATION PROCESSING LOAD AS A HUMAN FACTORS CRITERION FOR COMPUTER SYSTEMS DESIGN. IN R.E. GRANDA & J.M. FINKELMAN (EDS.), THE ROLE OF HUMAN FACTORS IN COMPUTERS (PROCEEDINGS OF A SYMPOSIUM CO-SPONSORED BY THE METROPOLITAN CHAPTER OF THE HUMAN FACTORS SOCIETY AND BARUCH COLLEGE, CITY UNIVERSITY OF NEW YORK). NEW YORK: HUMAN FACTORS SOCIETY, METROPOLITAN CHAPTER, 1976, 1-6.
DESCRIPTION:

HOW DO WE EVALUATE THE EFFICIENCY AND EFFECTIVENESS OF A COMPUTER SYSTEM? TRADITIONALLY, WE HAVE CONSIDERED SUCH MEASURES AS COST, SPEED, CAPACITY AND TECHNICAL SOPHISTICATION. RARELY ARE WE CONCERNED WITH THE "EASE OF OPERATION" FACTOR FOR THE COMPUTER OPERATOR, THE PROGRAMMER, OR THE UNSOPHISTICATED USER. WE HAVE FAILED TO CONSIDER THE INFORMATION PROCESSING LOAD IMPOSED BY A COMPUTER SYSTEM ON ITS USERS.

IT IS IRONIC THAT A SYSTEM WHICH IS SO OFTEN EVALUATED IN TERMS OF ITS INFORMATION PROCESSING CAPACITY IS RARELY APPRAISED IN TERMS OF THE DEMANDS WHICH IT MAKES UPON THOSE WHO EMPLOY IT. THE GOAL OF THE HUMAN FACTORS ENGINEER WHO IS ASSOCIATED WITH COMPUTER SYSTEM DESIGN SHOULD BE TO FACILITATE THE DEVELOPMENT OF A SWSTEM WHICH SHYFTS THE GREATEST POSSIBLE LOAD FROM THE USER TO THE MACHINE. (A) 6P, OR.

COMMENTS:

THIS BRIEF PAPER PROVIDES A SUCCINCT, INTUITIVELY APPEALING DEFINITION OF THE GOAL OF HUMAN FACTORS SPECIALISTS INVOLVED WITH COMPUTER SYSTEM DESIGN. ALTHOUGH REDUCING THE INFORMATION PROCESSING LOAD IMPOSED ON THE USER OF A SYSTEM IS DESIRABLE, THIS IS PROBABLY A NON-TRIVIAL TASK. THIS DEFINITION DOES, HOWEVER, SUGGEST A USEFUL APPROACH -- THE ANALYSIS OF THE HUMAN INFORMATION PROCESSING DEMANDS OF A GIVEN TASK DURING ALL PHASES OF SYSTEM DEVELOPMENT. THE AUTHOR ILLUSTRATES THIS CONCEPT BY BRIEFLY REVIEWING THE USE OF COMPUTER SYSTEMS FOR AIR RAFFIC CONTROL. THIS PAPER WOULD BE RELEVANT PRIMARILY TO HUMAN FACTORS SPECIALISTS INVOLVED WITH COMPUTER SYSTEM DESIGN AND DEVELOPMENT.

157 MANAGEMENT INFORMATION SYSTEMS
FINN, K.R., & MILLER, H.B. IS YOUR MIS FIT FOR HUMAN CONSUMPTION? INDUSTRIAL
ENGINEERING, NOVEMBER 1971, 3(11), 18-20.
DESCRIPTION:

SUCCESSFUL UTILIZATION OF INFORMATION -- AND THE MANAGEMENT INFORMATION SYSTEM (MIS) WHICH SUPPLIES IT -- DEPENDS UPON CONSIDERATION OF THE HUMAN CLIMATE PROVIDED TO RECEIVE THE DATA, AS WELL AS THE MEDIUM THROUGH WHICH INFORMATION IS PROCESSED. (A)

THIS PAPER DISCUSSES TEN PRINCIPLES FOR EVALUATING A MANAGEMENT INFORMATION SYSTEM. THESE PRINCIPLES CENTER ON FREE AND OPEN COMMUNICATION, A HIGH RISK TOLERANCE, DECENTRALIZED DECISION MAKING, A CONGRUENCE BETWEEN STATED AND ACTUAL POLICY AND SIMILARITIES BETWEEN THE GDALS OF THE ORGANIZATION AND ITS EMPLOYEES."

3P, OR.

COMMENTS:

THE PRINCIPLES DISCUSSED IN THIS PAPER ARE VERY GENERAL. THEY STATE PRIMARILY THAT THE INFORMATION PROVIDED BY A MANAGEMENT INFORMATION SYSTEM (AUTOMATED OR NOT) MUST BE CREDIBLE AND RELEVANT TO THE USER IN TERMS OF BOTH HIS OWN GOALS AND THOSE OF THE ORGANIZATION. THE PAPER MAY PROVIDE USEFUL INSIGHTS TO MANAGERS WHO ARE JUST BEGINNING TO CONSIDER WHAT FORM THEIR MIS'S SHOULD TAKE (THAT IS THE PURPOSE FOR WHICH THE PAPER WAS INTENDED), BUT IT IS UNLIKELY TO PROVIDE MUCH NEW INFORMATION TO THOSE WHO ARE OTHERWISE WELL-READ IN THE FIELD.

158 HUMAN FACTORS GUIDELINES FOR AUTOMATED CHECKOUT SYSTEMS
FIRSTMAN, S.I., & JORDAN, N. OPERATIONAL AND HUMAN FACTORS IN PLANNING
AUTOMATED MAN-MACHINE CHECKOUT SYSTEMS (REPORT NO. RM-2835-PR). SANTA
MONICA, CALIFORNIA: RAND CORP., APRIL 1962. (NTIS NO. AD 280259)
DESCRIPTION:

MANY MILITARY SYSTEMS ARE DEPENDENT UPON AUTOMATED CHECKOUT EQUIPMENT FOR THEIR OPERATIONAL EFFECTIVENESS. THIS REPORT IS INTEMDED AS AN AID TO AUTOMATED CHECKOUT SYSTEM PLANNING AND DESIGN. FIRST, THE REPORT CONSIDERS THE NATURE OF AN ADEQUATE OVERALL SYSTEM ANALYSIS AND THE MANNER IN WHICH SUCH AN ANALYSIS CAN LEAD TO DESIRABLE DESIGN CHARACTERISTICS FOR TESTING. THE CAPABILITIES AND LIMITATIONS OF PRESENT AUTOMATED TEST EQUIPMENT AND PERSONNEL ARE DELINEATED AND DISCUSSED. THE DESIGN FEATURES NECESSARY FOR EFFECTIVE MAN-MACHINE TEAMWORK AND FOR INTEGRATING AN AUTOMATED SYSTEM INTO A LARGER SYSTEM ARE ALSO CONSIDERED. (A, ABBR.) 65P, 14R.

COMMENTS:

THIS REPORT IS INTENDED AS A HANDBOOK TO BE USED IN THE DESIGN AND EVALUATION OF AUTOMATED CHECKOUT SYSTEMS. EVEN THOUGH THIS REPORT IS QUITE DATED AND MANY OF THE CONCEPTS AND DISCUSSIONS ARE, THEREFORE, NOT CURRENTLY RELEVANT, IT DOES INDICATE THE DIFFICULTY IN DEVELOPING AN ADEQUATE HANDBOOK FOR EVEN A LIMITED TYPE OF SYSTEM. MANY OF THE PROPOSED GUIDELINES ARE VERY GENERAL (E.G., SYSTEM SHOULD BE RELIABLE AND FLEXIBLE) AND THE STEPS REQUIRED TO IMPLEMENT THESE GUIDELINES ARE NOT CLEARLY DEFINED. THE LAST SECTION OF THIS PAPER DESCRIBES A "CONSERVATIVE PHILOSOPHY" OF SYSTEM DESIGN AND MIGHT BE OF INTEREST TO THOSE CONCERNED WITH SYSTEM DESIGN.

159 MODEL OF GRAPHICAL SYSTEM RESPONSE TIME
FOLEY, J.D. AN APPROACH TO THE OPTIMUM DESIGN OF COMPUTER GRAPHICS SYSTEMS.
COMMUNICATIONS OF THE ACM, 1971, 14, 380-39D.
DESCRIPTION:

DISPLAY SYSTEM DESIGNERS ARE FACED WITH THE DIFFICULT TASK OF SELECTING MAJOR SUBSYSTEMS IN AN INTELLIGENT WAY. EACH SUBSYSTEM IS CHOSEN FROM LARGE NUMBERS OF ALTERNATIVES; THE SELECTION IS BASED ON CONSIDERATIONS SUCH AS SYSTEM RESPONSE TIME, SYSTEM COST, AND THE DISTRIBUTION OF DATA STORAGE AND PROCESSING BETWEEN THE GRAPHICS PROCESSOR AND ITS SUPPORTING DATA PROCESSING SYSTEM. THE WORK REPORTED HERE DEVELOPS AN OBJECTIVE, QUANTITATIVE DESIGN PROCEDURE AND HELPS GIVE A BETTER UNDERSTANDING OF HOW TO CONFIGURE DISPLAY SYSTEMS. THIS IS ACCOMPLISHED BY MEANS OF A MATHEMATICAL MODEL OF A COMPUTER DRIVEN GRAPHICS SYSTEM.

THE PARAMETERS OF THE MODEL ARE FUNCTIONS OF THE CAPABILITIES OF THE GRAPHICS HARDWARE AND OF THE COMPUTATIONAL REQUIREMENTS OF THE GRAPHICS APPLICATION. THE MODEL CAN BE ANALYZED USING A NUMERICAL QUEUEING ANALYSIS OR SIMULATION TO OBTAIN AN AVERAGE RESPONSE TIME PREDICTION. BY COMBINING THE MODEL WITH AN OPTIMIZATION, THE BEST GRAPHICS SYSTEM CONFIGURATION, SUBJECT TO A COST CONSTRAINT, IS FOUND FOR SEVERAL APPLICATIONS. THE OPTIMUM CONFIGURATIONS ARE IN TURN USED TO FIND GENERAL DISPLAY SYSTEM DESIGN GUIDELINES. (A) 11P, 19R.

#### COMMENTS:

IN THIS PAPER, "OPTIMUM" IS DEFINED AS MINIMIZING A SYSTEM'S RESPONSE TIME FOR A GIVEN SYSTEM COST AND THE FOCUS IS ON THE HARDWARE CONFIGURATION NECESSARY TO ACHIEVE THIS OBJECTIVE. THE MODEL PROPOSED IN THIS PAPER APPEARS TO BE VERY USEFUL FOR THIS PURPOSE. THE AUTHOR ALSO ILLUSTRATES THE EXTREMELY WIDE RANGE IN SYSTEM RESPONSE TIME FOR A GIVEN COST AND OFFERS SUGGESTIONS ON HOW TO ACHIEVE THE MAXIMUM IMPROVEMENT IN EXISTING SYSTEMS FOR THE LEAST COST. THIS MODEL REQUIRES TWO TYPES OF DATA -- HARDWARE DATA AND APPLICATION DATA. WHILE HARDWARE DATA ARE RELATIVELY EASY TO OBTAIN, APPLICATION DATA, SUCH AS FILE AND CORE SPACE REQUIRED, COMMAND LENGTH, TIME BETWEEN COMMANDS, ETC., ARE MORE DIFFICULT TO OBTAIN. THE AUTHOP DOES PRESENT APPLICATION DATA ESTIMATES FOR TEXT EDITING, NETWORK ANALYSIS, AND GRAPHICS APPLICATIONS, THOUGH. THIS PAPER DOES NOT ADDRESS HUMAN FACTORS ISSUES IN SYSTEM OR TERMINAL DESIGN. IT DOES, HOWEVER, PRESENT A CONCEPTUAL BASIS FOR VIEWING HARDWARE CONSIDERATIONS AND IT MAY BE USEFUL TO EXTEND THE PROPOSED MODEL TO ACCOUNT FOR HUMAN FACTORS ISSUES BY INCLUDING SUCH ISSUES IN THE APPLICATION DATA.

160 INTERACTIVE GRAPHICS

FOLEY, J.D., & WALLACE, V.L. THE ART OF NATURAL GRAPHIC MAN-MACHINE CONVERSATION. PROCEEDINGS OF THE IEEE, 1974, 62, 462-471.

DESCRIPTION:

THE DESIGN OF INTERACTIVE GRAPHIC SYSTEMS WHOSE AIM IS GOOD SYMBIOSIS BETWEEN MAN AND MACHINE INVOLVES NUMEROUS FACTORS. MANY OF THOSE FACTORS CAN BE JUDGED FROM THE PERSPECTIVE OF NATURAL SPOKEN CONVERSATION BETWEEN TWO PEOPLE.

GUIDING RULES AND PRINCIPLES FOR DESIGN OF SUCH SYSTEMS ARE PRESENTED AS A FRAMEWORK FOR A SURVEY OF DESIGN TECHNIQUES FOR MAN-MACHINE CONVERSATION. ATTENTION IS ESPECIALLY FOCUSED ON IDEAS OF ACTION SYNTAX STRUCTURING, LOGICAL EQUIVALENCES AMONG ACTION DEVICES, AND AVOIDANCE OF PSYCHOLOGICAL BLOCKS TO COMMUNICATION. (A) 10P, 33R.

COMMENTS:

THIS PAPER IS A FAIRLY BROAD TREATMENT OF INTERACTIVE GRAPHICAL MAN-COMPUTER DIALOGUE TECHNIQUES. IT PRESENTS A FEW INFORMAL PRINCIPLES AND A LARGE NUMBER OF GUIDELINES AND IDEAS FOR SPECIFIC GRAPHICAL INPUT/OUTPUT TECHNIQUES. THE AUTHORS' EMPHASIS IS ON THE USE OF COMMAND LANGUAGE PROPERTIES AND GRAPHICAL INPUT TECHNIQUES WHICH RESULT IN HIGHLY "NATURAL" DIALOGUE (THOUGH NOT NECESSARILY "NATURAL-LANGUAGE" DIALOGUE). AS A SOURCE OF IDEAS, THIS PAPER IS EXCELLENT; IT IS DOUBTFUL THAT EVEN THOSE WITH CONSIDERABLE EXPERIENCE IN SUCH SYSTEMS CAN READ THIS PAPER WITHOUT FINDING A FEW USEFUL NEW TECHNIQUES. THE GUIDELINES PRESENTED ARE GENERALLY GOOD, BUT THE AUTHORS DO NOT ATTEMPT TO PRESENT, OR POINT TO, SUPPORTING INFORMATION SUCH AS PERFORMANCE DATA OR COST. AS A RESULT, THE GUIDELINES MAY HELP THE READER RECOGNIZE THAT A PARTICULAR FEATURE IS DESIRABLE, BUT THEY WILL NOT HELP HIM MAKE TRADEOFF DECISIONS. THE DISCUSSION OF THE LOGICAL PROPERTIES OF SEVERAL ABSTRACT CLASSES OF INPUT DEVICES ("VIRTUAL INPUT DEVICES") INCLUDING THE "PICK", "BUTTON", "LOCATOR", AND "VALUATOR" IS INTERESTING. THE PAPER IS CERTAINLY RELEVANT TO THOSE INTERESTED IN INTERACTIVE GRAPHICS, BUT MAY ALSO BE HELPFUL TO THOSE CONCERNED WITH OTHER DIALOGUE TYPES AND WITH COMMAND LANGUAGE PROPERTIES.

161 INTERPERSONAL DIALOGUE WITH LIMITED WORD USAGE FORD, W.R. SELF-LIMITED AND UNLIMITED WORD USAGE DURING PROBLEM SOLVING IN TWO TELECOMMUNICATION MODES (TECHNICAL REPORT NO. 7). BALTIMORE, MARYLAND: JOHNS HOPKINS UNIVERSITY, DEPARTMENT OF PSYCHOLOGY, APRIL 1977. DESCRIPTION:

SUBJECTS USING ORAL MODES OF COMMUNICATION GENERATE FAR MORE VERBIAGE THAN DO SUBJECTS USING WRITTEN (HANDWRITTEN OR TYPEWRITTEN) MODES TO SOLVE THE SAME PROBLEMS. THIS STUDY WAS DESIGNED TO PROVIDE SUPPORT FOR ONE OF TWO ALTERNATIVE HYPOTHESES THAT HAVE BEEN PROPOSED TO ACCOUNT FOR THIS DISPARITY: (1) WRITTEN MODES PRODUCE A HARD COPY OF INTERCHANGES THAT CAN BE REFERRED TO AT ANY TIME, THEREBY COMPENSATING FOR THE LIMITATIONS OF SHORT-TERM MEMORY AND REDUCING THE NEED TO REPEAT INFORMATION, AND (2) TALKING IS SO MUCH EASIER THAN HANDWRITING OR TYPEWRITING THAT THERE IS NO INCENTIVE TO BE CONCISE IN ORAL MODES. TWO-PERSON TEAMS OF SUBJECTS SOLVED PROBLEMS COOPERATIVELY USING EITHER A VOICE OR A TELETYPEWRITER MODE OF COMMUNICATION. HALF THE TEAMS WERE GIVEN A MONETARY INCENTIVE TO USE AS FEW WORDS AS POSSIBLE. NO SUCH REQUEST WAS MADE OF THE CONTROL TEAMS. THE MAIN FINDING WAS THAT SUBJECTS IN THE BREVITY CONDITION, REGARDLESS OF THE COMMUNICATION MODE, GREATLY REDUCED VERBIAGE WITH NO INCREASE IN TIME OR DECREASE IN ACCURACY. MOREOVER, SUBJECTS IN THE BREVITY-WOICE CONDITION USED EVEN FEWER WORDS THAN DID SUBJECTS IN THE CONTROL-TELETYPEWRITER CONDITION. THESE RESULTS, THEN, LEND WEIGHT TO THE SECOND HYPOTHESIS. (A) 35P, 10R.

COMMENTS:

THIS IS ONE OF A SERIES OF STUDIES BY A. CHAPANIS AND HIS COLLEAGUES AT JOHNS HOPKINS UNIVERSITY ON INTERPERSONAL DIALOGUE. THE QUESTION OF WHETHER DECREASING THE NUMBER OF WORDS USED DEGRADES PROBLEM SOLVING PERFORMANCE IS WORTH INVESTIGATING AND THE CONCLUSION, THAT IT DOES NOT, HAS POSSIBLE IMPLICATIONS FOR INTERACTIVE PROBLEM SOLVING SYSTEMS. IN THIS, AND SIMILAR, STUDIES A LARGE NUMBER OF DEPENDENT AND INDEPENDENT VARIABLES ARE INVOLVED. THIS RAISES THE QUESTION OF WHICH OBSERVED STATISTICALLY SIGNIFICANT EFFECTS HAVE PRACTICAL SIGNIFICANCE AND WHICH WERE OBSERVED ONLY BY CHANCE. FOUR SIGNIFICANT EFFECTS INVOLVING SEX WERE OBSERVED, FOR EXAMPLE, BUT THE AUTHOR TREATS THIS AS A CHANCE RESULT. ALTHOUGH THIS MAY BE APPROPRIATE IN VIEW OF UNCITED EVIDENCE FROM OTHER STUDIES IN THIS SERIES, THE SUBJECTIVE CLASSIFICATION OF EFFECTS AS BEING EITHER OF PRACTICAL SIGNIFICANT OR ONLY OF CHANGE SIGNIFICANCE MAY TEND TO OBSCURE THE ACTUAL RESEARCH RESULTS.

162 INTERPERSONAL DIALOGUE FORD, W.R. SELF-LIMITED AND UNLIMITED WORD USAGE DURING PROBLEM SOLVING IN TWO TELECOMMUNICATION MODES. IN PROCEEDINGS OF THE 21ST ANNUAL MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1977, 501-504.

DESCRIPTION:

SUBJECTS USING ORAL MODES OF COMMUNICATION GENERATE FAR MORE VERBIAGE THAN DO SUBJECTS USING WRITTEN (HANDWRITTEN OR TYPEWRITER) MODES TO SOLVE THE SAME PROBLEMS. THIS STUDY WAS DESIGNED TO PROVIDE SUPPORT FOR ONE OF TWO ALTERNATIVE HYPOTHESES THAT HAVE BEEN PROPOSED TO ACCOUNT FOR THIS DISPARITY: (1) WRITTEN MODES PRODUCE A HARD COPY OF INTERCHANGES THAT CAN BE REFERRED TO AT ANY TIME, THEREBY COMPENSATING FOR THE LIMITATIONS OF SHORT-TERM MEMORY AND REDUCING THE NEED TO REPEAT INFORMATION, AND (2) TALKING IS SO MUCH EASIER THAN HANDWRITING OR TYPEWRITING THAT THERE IS NO INCENTIVE TO BE CONCISE IN ORAL MODES. TWO-PERSON TEAMS OF SUBJECTS SOLVED PROBLEMS COOPERATIVELY USING EITHER A VOICE OR A TELETYPEWRITER MODE OF COMMUNICATION. HALF THE TEAMS WERE GIVEN A MONETARY INCENTIVE TO USE AS FEW WORDS AS POSSIBLE. NO SUCH REQUEST WAS MADE OF THE CONTROL TEAMS. THE MAIN FINDING WAS THAT SUBJECTS IN THE BREVITY CONDITION, REGARDLESS OF THE COMMUNICATION MODE, GREATLY REDUCED VERBIAGE WITH NO INCREASE IN TIME OR DECREASE IN ACCURACY. MOREOVER, SUBJECTS IN THE BREVITY-WOICE CONDITION USED EVEN FEWER WORDS THAN DID SUBJECTS IN THE BREVITY-WOICE CONDITION USED EVEN FEWER WORDS THAN DID SUBJECTS IN THE SECOND HYPOTHESIS. (A) 4P, 10R.

COMMENTS:

THIS IS A CONDENSED VERSION OF A TECHNICAL REPORT BY W. R. FORD (1977). THOSE WISHING A DETAILED DESCRIPTION OF THE EXPERIMENTAL PROCEDURE, STATISTICAL ANALYSES AND UNDERLYING RATIONALE SHOULD CONSULT THE TECHNICAL REPORT VERSION. THOSE WISHING ONLY A BRIEF DESCRIPTION OF PROCEDURES AND PRINCIPAL RESULTS WOULD FIND THE SHORTER VERSION ADEQUATE.

163 CRT DISPLAYS

FRANK, W.L. ON-LINE CRT DISPLAYS: USER TECHNOLOGY AND SOFTWARE. IN E. BURGESS (ED.), ON-LINE COMPUTING SYSTEMS: PROCEEDINGS OF THE SYMPOSIUM. DETROIT, MICHIGAN: AMERICAN DATA PROCESSING, INC., 1965, 50-62.
DESCRIPTION:

THIS PAPER EXPLORES THE CURRENT STATE OF THE ART OF CRT DISPLAYS AND DISCUSSES, FROM THE USER'S POINT OF VIEW, POTENTIAL APPLICATIONS AND THE COMPUTER PROGRAMMING SOFTWARE NECESSARY TO IMPLEMENT THESE SYSTEMS. (A) 13P, DR.

COMMENTS:

THIS IS AN EARLY DISCUSSION OF CRT DISPLAYS. THE COMPARISON OF SPECIFIC DISPLAYS IS, OF COURSE, DATED. THE AUTHOR ATTEMPTS TO RELATE, IN TABULAR FORM, SOFTWARE REQUIREMENTS TO HARDWARE REQUIREMENTS AND THE PHYSICAL AND FUNCTIONAL PROPERTIES OF DISPLAYS TO VARIOUS APPLICATION AREAS. THE RESULTING TABLES ARE NOT ENTIRELY SATISFACTORY. THIS PROBABLY INDICATES, HOWEVER, THE DIFFICULTY IN IDENTIFYING AND QUANTIFYING ALL RELEVANT PARAMETERS AND THE VARIABILITY IN REQUIREMENTS FOR VARIOUS SYSTEMS WITHIN A SINGLE APPLICATION AREA.

164 USER ACCEPTANCE OF AN INTERACTIVE GRAPHICS SYSTEM FRANKLIN, J., & DEAN, E. SOME EXPECTED AND NOT SO EXPECTED REACTIONS TO A COMPUTER-AIDED DESIGN WITH INTERACTIVE GRAPHICS (CANDIG) SYSTEM. SID JOURNAL, 4AY-JUNE 1974, PP. 5-6, 9, 11-13. DESCRIPTION:

THERE ARE TWO FACTORS ASSOCIATED WITH BATCH PROCESSING TECHNIQUES THAT PREVENT THE EFFECTIVE USE OF COMPUTERS FOR ELECTRONIC CIRCUIT ANALYSIS. FIRST, USERS ARE RELUCTANT TO LEARN THE REQUIRED CODES AND PROGRAMMING LANGUAGES, AND SECOND, BATCH PROCEDURES ARE EXTREMELY TIME-CONSUMING AND ERROR PRONE.

INTRODUCTION OF A GRAPHICS SYSTEM, IT WAS FELT, WOULD BE WELCOMED.
BUT THE REACTIONS TO THE SYSTEM FROM STUDENTS AND EXPERIENCED USERS WAS A
LITTLE DISCONCERTING TO THE SPONSORS. HERE IS TOLD HOW STUDENTS AND
OTHERS REACTED. (A)
6P, OR.

COMMENTS:

THIS IS A VERY INTERESTING PAPER. ALTHOUGH EASE OF USE IS UNDOUBTEDLY AN IMPORTANT FACTOR IN GAINING USER ACCEPTANCE, THIS PAPER ILLUSTRATES THAT IT IS NOT SUFFICIENT FOR USER ACCEPTANCE. THE AUTHORS INFORMALLY DESCRIBE THEIR EXPERIENCES WITH AN INTERACTIVE GRAPHICS SYSTEM AND OFFER OPINIONS CONCERNING THE POORER THAN EXPECTED ACCEPTANCE AND USE OF THIS SYSTEM. A SIMILAR PAPER, CONCERNED WITH ARCHITECTURAL APPLICATIONS, HAS BEEN PRESENTED BY G. GREENWALD-KATZ (1976). THE PRESENT PAPER OFFERS SOME THOUGHT-PROVOKING IDEAS FOR ANYONE INTERESTED IN THE USE OF INTERACTIVE SYSTEMS.

165 NATURAL-LANGUAGE DIALOGUE
FRASER, J.B. ON THE ROLE OF NATURAL LANGUAGE IN MAN-MACHINE COMMUNICATION. IN
D.E. WALKER (ED.), INFORMATION SYSTEM SCIENCE AND TECHNOLOGY: PAPERS PREPARED
FOR THE THIRD CONGRESS. WASHINGTON, D.C.: THOMPSON, 1967, 21-28.
DESCRIPTION:

NATURAL-LANGUAGE MAN-COMPUTER DIALOGUE IS FREQUENTLY CRITICIZED AS TOO COMPLICATED, INEFFICIENT, AND UNNECESSARY. SUCH CRITICISMS ARE GENERALLY MADE WITHOUT A CLOSE EXAMINATION OF EXPERIENCE WITH A NATURAL LANGUAGE SYSTEM. THIS PAPER EMPHASIZES THE FACT THAT THE ROLE OF NATURAL LANGUAGE IN COMPUTER SYSTEMS IS OFTEN NOT PLACED IN THE PROPER PERSPECTIVE AND ATTEMPTS TO RECTIFY THIS SITUATION.

8P, 6R.

IT MAY WELL BE, AS THE AUTHOR POINTS OUT, THAT NATURAL LANGUAGE IS AN APPROPRIATE DIALOGUE TYPE FOR INFREQUENT USERS WHO USE AN INTERACTIVE SYSTEM FOR SIMPLE INFORMATION RETRIEVAL. NO SERIOUS ATTEMPT IS MADE, HOWEVER, TO SUPPORT THIS ASSUMPTION. THE AUTHOR CLAIMS THAT A NATURAL LANGUAGE DIALOGUE SYSTEM WOULD IMPROVE SERIOUS CONSTRAINTS ON THE VOCABULARY AND SYNTACTIC STRUCTURES THAT COULD BE PROCESSED, BUT FAILS TO CONSIDER HOW THESE CONSTRAINTS MIGHT EFFECT THE USER OF THE SYSTEM. SEVERAL EXAMPLES ARE PRESENTED OF WHAT SUCH A SYSTEM "MIGHT" DO, BUT WHAT THE SYSTEM "OUGHT TO" DO IS NOT CONSIDERED. THIS PAPER IS, IN GENERAL, AN INADEQUATE TREATMENT OF THE QUESTION OF THE FEASIBILITY AND DESIRABILITY OF NATURAL LANGUAGE DIALOGUE AND ALSO FAILS TO TREAT THE CLOSELY RELATED ISSUE OF QUERY LANGUAGES.

166 GENERAL REVIEW OF HUMAN FACTORS IN COMPUTER SYSTEMS
FREDERIKSEN, J.R. SURVEY OF THE STATE-OF-THE-ART IN HUMAN FACTORS IN COMPUTERS
(TECHNICAL REPORT SAI-75-533-WA). ARLINGTON, VIRGINIA: SCIENCE APPLICATIONS,
INC., JULY 1975.
DESCRIPTION:

THIS PAPER BEGINS WITH A BRIEF DISCUSSION OF SOME GENERAL ISSUES INVOLVED IN DESIGNING INTERACTIVE SYSTEMS THAT ARE OPTIMALLY CONSTRUCTED WITH RESPECT TO THE HUMAN USER. THESE ISSUES ARE: DISPLAY DESIGN, INTERACTIVE LANGUAGES, TRAINING, RESPONSE MODE, TASK ALLOCATION, PERSONALIZATION, AND MEASUREMENT. THE AUTHOR THEN BRIEFLY REVIEWS THE LITERATURE IN THE AREAS OF TERMINAL DESIGN, USER BEHAVIOR, EVALUATION OF MAN-COMPUTER SYSTEMS, AND INDIVIDUAL DIFFERENCES AND POINTS OUT THE RELEVANCE OF THIS LITERATURE TO THE ISSUES CITED ABOVE.

33P, 70R.

COMMENTS:

THIS PAPER IS AN EXCELLENT SOURCE FOR REFERENCES IN THE AREA OF MAN-COMPUTER INTERACTION. THE AUTHOR CITES A LARGE MUMBER OF PAPERS AND BRIEFLY, BUT ACCURATELY, DESCRIBES THE CONCLUSIONS REPORTED IN THESE PAPERS. AS A REVIEW PAPER, HOWEVER, IT IS NOT TOTALLY ADEQUATE; THE AUTHOR DOES NOT COMMENT ON THE VALIDITY OR GENERALITY OF ANY OF THE REPORTED CONCLUSIONS. THUS, ALTHOUGH THE READER IS PRESENTED WITH A GREAT DEAL OF INFORMATION, HE IS NOT PROVIDED SUFFICIENT BACKGROUND MATERIAL TO MEANINGFULLY INTERPRET THIS INFORMATION. THE PAPER DOES PROVIDE A CONCISE INTRODUCTION TO STUDIES OF MAN-COMPUTER INTERACTION AND IT COULD BE USED AS A SOURCE OF REFERENCES IN THIS AREA.

# 167 COMPUTER-AIDED DECISION MAKING

FREEDY, A., DAVIS, K.B., STEEB, R., SAMET, M.G., & GARDINER, P.C. ADAPTIVE COMPUTER AIDING IN DYNAMIC DECISION PROCESSES: METHODLOGY, EVALUATION, AND APPLICATIONS (TECHNICAL REPORT PFTR-1016-76-8/30). WOODLAND HILLS, CALIFORNIA: PERCEPTRONICS, INC., AUGUST 1976. DESCRIPTION:

THIS IS THE FINAL REPORT OF A THREE YEAR PROGRAM DIRECTED TOWARD THE DESIGN AND DEVELOPMENT OF A DECISION SUPPORT SYSTEM FOR TACTICAL OPERATIONS.
TERMED ADDAM (ADAPTIVE DYNAMIC DECISION AIDING METHODOLOGY), THE SYSTEM USES ADAPTIVE MODELS BOTH TO CAPTURE THE DECISION MAKER'S STRATEGY AND TO SUGGEST ACTIONS. THE REPORT PRESENTS THEORETICAL AND METHODOLOGICAL REVIEWS, AS WELL AS THE RESULTS OF THE MOST RECENT EXPERIMENTAL STUDY.

EARLIER STUDIES OF ADDAM SHOWED THAT IT IS CAPABLE OF MODELING AND PREDICTING DECISION BEHAVIOR, AND OF IMPROVING DECISION CONSISTENCY. THE CURRENT STUDY EXTENDS THESE FINDINGS BY DEMONSTRATING THAT ADAPTIVE AIDING CAN ALSO IMPROVE EXTERNAL PERFORMANCE MEASURES IN A REALISTIC TASK. THE EXPERIMENTAL CONTEXT WAS A SIMULATED ASW TASK MUCH LIKE THAT FACED BY AN ASW OPERATIONS OFFICER. THE OPERATOR TRACKED AND REPORTED ON THE MOVEMENTS OF A SUBMARINE AND AN INTERFERING OBJECT, USING THE SAME TYPES OF SENSORS (SONOBUOYS, HELICOPTERS, MAD'S, ETC.) AVAILABLE IN NAVAL ASW EXERCISES. THE SENSORS VARIED IN RELIABILITY, IN SPECIFICITY, AND IN COST. TWELVE AIR NATIONAL GUARD RESERVISTS SERVED AS SUBJECTS IN THE STUDY, SIX MITHOUT AIDING AND SIX WITH. AIDED OPERATORS RECEIVED COMPUTER ASSISTANCE IN THE FORM OF (1) SENSOR OUTPUT EVALUATION, AND (2) SENSOR PLACEMENT RECOMMENDATIONS. THE LATTER WERE BASED ON THEIR OWN UTILITIES FOR SENSOR INFORMATION, DERIVED IN PREVIOUS TRAIMING SESSIONS BY MEANS OF A TRAINABLE PATTERN RECOGNITION PROGRAM. THE RESULTS SHOWED THAT THE AIDED GROUP PERFORMANCE SCORE IMPROVED BY BBX DUE TO GAINS IN BOTH DECISION THROUGHPUT AND DECISION QUALITY. ALSO, THE AIDED GROUP SHOWED GREATER DECISION CONSISTENCY AND LOWER INTRA-GROUP VARIABILITY.

THE REPORT DISCUSSES THE PRACTICAL APPLICATION OF ADAPTIVE DECISION THE REPORT DISCUSSES THE PRACTICAL APPLICATION OF ADAPTIVE DECISION

THE REPORT DISCUSSES THE PRACTICAL APPLICATION OF ADAPTIVE DECISION MODELING IN PROVIDING A FRAMEWORK FOR DECISION ANALYSIS AND FEEDBACK. THE NORMATIVE EXPECTED UTILITY APPROACH SHOWS PARTICULAR APPLICABILITY IN SITUATIONS OF HIGH RISK, COMPLEXITY, AND SPEED. (A)

### COMMENTS:

THIS REPORT SUMMARIZES A LONG-TERM RESEARCH PROJECT, VARIOUS ASPECTS OF WHICH WERE PREVIOUSLY REPORTED BY THESE AUTHORS. THE MOST IMPORTANT ASPECT OF THE EXPERIMENT REPORTED HERE IS THAT IT EXTENDS THE CONCEPTS PREVIOUSLY DEVELOPED INTO A MORE REALISTIC EXPERIMENTAL TASK. ADDAM OFFERS THE PROMISE OF BEING VERY USEFUL IN TACTICAL DECISION MAXING SITUATIONS. IN SUCH SITUATIONS, THE DECISION MAKER IS CONFRONTED WITH A VAST AMOUNT OF INFORMATION, SOME RELEVANT AND SOME IRRELEVANT, AND MUST MAKE DECISIONS UNDER FAIRLY SEVERE TIME PRESSURE. THE SYSTEM DEVELOPED IN THIS RESEARCH PROJECT COULD AID SIGNIFICANTLY IN FILTERING INFORMATION AND IN GENERATING AND EVALUATING FEASIBLE ALTERNATIVE COURSES OF ACTION.

168 ADAPTIVE DECISION AIDING

FREEDY, A., WEISBROD, R., MAY, D., SCHWARTZ, S., & WELTMAN, G. ADAPTIVE COMPUTER DECISION AIDING IN DYNAMIC DECISION PROCESSES: ANALYSIS AND DESIGN (TECHNICAL REFORT PTR-73-101). ENCINO, CALIFORNIA: PERCEPTRONICS, INC., OCTOBER 1973. (HTIS NO. AD 769113) DESCRIPTION:

IN DYNAMIC DECISION PROCESSES WITH FALLIBLE, HIGH-VOLUME DATA, DECISION MAKERS (DM) MUST FREQUENTLY RESPOND TO NON-STATIONARY ENVIRONMENTS AND EMPLOY INFORMATION SOURCES OF VARYING RELIABILITY AND COST. HUMAN PERFORMANCE IN MILITARY TASKS -- SUCH AS INTELLIGENCE GATHERING -- IS IMPAIRED BY FACTORS SUCH AS COGNITIVE CONSTRAINTS, SUBJECTIVE BIASES, AND LIMITATIONS OF THE OPERATOR'S INFORMATION-PROCESSING CAPABILITIES.

DECISION-AIDING TECHNIQUES WHICH EMPLOY AUXILIARY COMPUTATIONAL FUNCTIONS OFFER A PROMISING MEANS FOR IMPROVING THE JUDGMENTAL PROCESS OF THE DM. OF MAJOR CONCERN IS THE EXPLORATION OF AIDING FUNCTIONS AND PROCEDURES WHICH CAN BEST COMPENSATE FOR THE INHERENT LIMITATIONS OF THE HUMAN.

THIS RESEARCH PROGRAM IS DIRECTED TOWARD THE APPLICATION OF ADAPTIVE COMPUTER TECHNIQUES FOR AIDING THE DECISION MAKER AND TOWARD THE EXPERIMENTAL INVESTIGATION OF THE FACTORS WHICH INFLUENCE OPTIMAL DECISION AIDING IN COMPLEX, REALISTIC, OPEN, INTELLIGENCE-GATHERING TASKS. THE TECHNIQUES CENTER AROUND A SYSTEM WHICH LEARNS THE BEHAVIOR OF A HUMAN IN A DECISION ENVIRONMENT BY ADJUSTING THE PARAMETERS OF AN EXPECTED-UTILITY MODEL. A MAXIMUM-LIKELIHOOD MODEL OF REAL-WORLD BEHAVIOR IS USED TO PREDICT ENVIRONMENT-STATE TRANSITIONS, AND AN EXPECTED UTILITY MODEL OF DECISION MAKER BEHAVIOR IS EMPLOYED TO PREDICT (AND SUGGEST) OPERATOR DECISIONS. BOTH THE CONDITIONAL PROBABILITIES OF STATE TRANSITIONS AND THE OPERATOR'S UTILITIES ARE ESTIMATED BY THE SYSTEM.

UTILITIES ARE ESTIMATED BY THE SYSTEM.

THIS REPORT INCLUDES: (1) A SURVEY OF RELEVANT LITERATURE, (2) A SYSTEM DESIGN FOR A DYNAMIC DECISION-AIDING SYSTEM, (3) A DESIGN FOR A SIMULATED REAL-WORLD, DYNAMIC DECISION TASK IN THE FORM OF AN INTELLIGENCE—GATHERING GAME, (4) THE DEVELOPMENT AND DISCUSSION OF TECHNIQUES FOR PERFORMANCE MEASUREMENT, AND (5) SPECIFICATIONS FOR SOFTWARE AND HARDWARE NECESSARY TO IMPLEMENT THE SYSTEM.

THIS REPORT SETS THE DOCUMENTARY AND TECHNICAL BASIS FOR THE IMPLEMENTATATION OF THE DYNAMIC DECISION-AIDING SYSTEM AND FOR THE DESIGN AND PERFORMANCE OF SUBSEQUENT EXPERIMENTS. (A) 127P, 53R.

#### COMMENTS:

THIS IS A VERY EXTENSIVE DISCUSSION OF THE AUTONOMOUS CONTROL SUBSYSTEM (ACS) AND THE ADAPTIVE DYNAMIC DECISION AIDING MACHINE (ADDAM). THOSE INTERESTED IN THE RATIONALE UNDERLYING THESE DEVELOPMENTS, AS WELL AS DETAILED DESCRIPTIONS OF THESE SYSTEMS WOULD FIND THIS PAPER APPROPRIATE. THOSE WISHING LESS DETAILED, BUT STILL ACCURATE, DESCRIPTIONS SHOULD SEE A. FREEDY AND G. WELTMAN (1974) FOR A DISCUSSION OF ADDAM AND A. FREEDY, G. WELTMAN, AND J. LYMAN (1972) FOR A DISCUSSION OF ACS. AN EXPERIMENTAL INVESTIGATION OF THESE SYSTEMS IS REPORTED IN G. WELTMAN, R. STEEB, A. FREEDY, M. SMITH, AND R. WEISBROD (1973).

169 COMPUTER-AIDED DECISION MAKING
FREEDY, A., & WELTMAN, G. ADAPTIVE COMPUTER AIDING IN DYNAMIC DECISION
PROCESSES. IN K.S. FU & J.T. TOU (EDS.), LEARNING SYSTEMS AND INTELLIGENT
ROBOTS. NEW YORK: PLENUM, 1974, 263-271.
DESCRIPTION:

THIS REPORT DESCRIBES IN BRIEF A RESEARCH PROGRAM DIRECTED TOWARD THE APPLICATION OF ADAPTIVE COMPUTER TECHNIQUES FOR AIDING THE HUMAN DECISION MAKER IN DYNAMIC DECISION PROCESSES. AIDING INFORMATION OF SEVERAL TYPES COMES FROM THE ON-LINE ACQUISITION OF THE DECISION MAKER'S VALUE STRUCTURE BY A TRAINABLE COMPUTER SYSTEM. A MAXIMUM-LIKELIHOOD MODEL OF REAL-WORLD BEHAVIOR IS USED TO PREDICT, EVALUATE, AND MODIFY OR AUTOMATE OPERATOR DECISIONS. THE OVERALL SYSTEM MODELS INFORMATION-ACQUISITION STRATEGY, AS WELL AS ACTION CHOICES. IT IS PRESENTLY BEING IMPLEMENTED ON AN INTERACTIVE MINICOMPUTER, AND APPLIED TO A SIMULATED INTELLIGENCE OPERATION INVOLVING SURVEILLANCE OF A MOBILE FISHING FLEET USING SENSORS OF VARYING COSTS AND RELIABILITIES. RESEARCH GOALS INCLUDE EXPERIMENTAL INVESTIGATION OF THE FACTORS WHICH INFLUENCE OPTIMAL DECISION AIDING IN COMPLEX, REALISTIC AND OPEN INTELLIGENCE—GATHERING AND DECISION-MAKING TASKS. A MAJOR CONCERN IS TO IDENTIFY AIDING TECHNIQUES WHICH BEST MATCH THE JUDGMENTAL ABILITIES OF MAN WITH THE DISCRIMINATIVE CAPACITY OF AN ADAPTIVE MACHINE. (A) 9P, 17R.

COMMENTS:

THIS IS A PRELIMINARY DESCRIPTION OF ADDAM (ADAPTIVE DYNAMIC DECISION AIDING MACHINE), WHICH IS AN EXTENSION OF THE AUTONOMOUS CONTROL SUBSYSTEM (ACS) DESCRIBED BY A. FREEDY, G. WELTMAN, AND J. LYMAN (1972). ADDAM IS INTENDED TO AID DECISION MAKING BY CONSTRUCTING A MODEL OF THE HUMAN DECISION MAKER'S STRATEGIES. THE SYSTEM COULD THEN DETECT INCONSISTENCIES IN THE DECISION MAKER'S JUDGMENTS, ESTIMATE THE RELATIVE VALUE OF DIFFERENT ACTIONS, OR EVEN AUTOMATICALLY TAKE OVER THE DECISION MAKING TASK. THIS LAST ASPECT, AUTOMATIC TAKEOVER, APPEARS TO REQUIRE CAREFUL CONSIDERATION OF USER ACCEPTANCE. OVERALL, THE CONCEPTS EXPRESSED IN THIS PAPER ARE QUITE GOOD. IT MAY PROVE VERY DIFFICULT, HOWEVER, TO DEVELOP ACCURATE MODELS OF A DECISION MAKER IN COMPLEX TASKS.

170 ADAPTIVE DECISION AIDING

FREEDY, A., WELTMAN, G., & LYMAN, J. INTERACTIVE ASPECTS OF A MAN/LEARNING SYSTEM CONTROL TEAM. IN PROCEEDINGS OF THE 1972 INTERNATIONAL CONFERENCE ON CYBERNETICS AND SOCIETY. NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., 1972, 135-140.

DESCRIPTION:

THIS PAPER DEALS WITH AN ONGOING INVESTIGATION OF THE RULES GOVERNING INTERACTION BETWEEN HUMAN OPERATORS AND ADAPTIVE LEARNING MACHINES IN CONTROL AND DECISION SITUATIONS. A SERIES OF STUDIES IS PLANNED TO ILLUMINATE THIS MAN-MACHINE AREA, WHICH, AFTER SOME YEARS OF SPECULATIVE INTEREST, HAS NOW REACHED PRACTICAL IMPORTANCE. THE PRESENT REPORT DESCRIBES THE ADAPTATION OF THE AWTONOMOUS CONTROL SUBSYSTEM (ACS) ORIGINALLY APPLIED IN MANIPULATOR CONTROL TO A MORE GENERAL TASK SITUATION AND DISCUSSES SOME EARLY EXPERIMENTAL RESULTS. (A)

COMMENTS:

THIS IS A PRELIMINARY DESCRIPTION OF THE AUTONOMOUS CONTROL SUBSYSTEM (ACS). AN INTERESTING ASPECT OF THIS SYSTEM IS AUTOMATIC TAKEOVER OF CONTROL IN A DECISION MAKING TASK BASED ON LEVEL-OF-CONFIDENCE CALCULATIONS BUILT INTO THE SYSTEM'S DECISION MODEL. ALTHOUGH AUTOMATIC TAKEOVER MAY BE USEFUL IN A VARIETY OF DECISION MAKING TASKS, THE IMPORTANT QUESTION OF USER ACCEPTANCE IS NOT ADEQUATELY ADDRESSED IN THIS PAPER. A MORE COMPLETE DISCUSSION OF THE ACS CAN BE FOUND IN G. WELTMAN, R. STREEB, A. FREEDY, M. SMITH, AND R. WEISBROD (1973).

171 INTERACTIVE DIALOGUE OF A MATHEMATICAL SYSTEM
FRIED, B.D. ON THE USER'S POINT OF VIEW. IN M. KLERER & J. REINFELDS (EDS.),
INTERACTIVE SYSTEMS FOR EXPERIMENTAL APPLIED MATHEMATICS: PROCEEDINGS OF THE
ASSOCIATION FOR COMPUTING MACHINERY SYMPOSIUM. NEW YORK: ACADEMIC PRESS,
1968, 11-21.

DESCRIPTION:
THIS PAPER DISCUSSES THE GENERAL CRITERIA THAT SEEM MOST APPROPRIATE FOR AN INTERACTIVE SYSTEM FOR THE EXPERIMENTAL SOLUTION OF MATHEMATICAL PROBLEMS AND DESCRIBES ONE SUCH SYSTEM.
11P, 3R.

COMMENTS:

THE INTERACTIVE SYSTEM DESCRIBED IN THIS PAPER IS INTENDED TO BE USED ONLY IN THE LIMITED DOMAIN OF EXPERIMENTAL APPLIED MATHEMATICS AND ONLY BY USERS WITH EXTENSIVE EXPERIENCE IN THIS DOMAIN. THIS GREATLY SIMPLIFIES THE TASK OF DESIGNING AN EFFECTIVE INTERACTIVE SYSTEM. THE USER HAS A WELL-DEFINED SET OF COMPLEX TERMS AND CONCEPTS THAT ARE APPLICABLE IN THIS TASK DOMAIN AND THESE TERMS AND CONCEPTS ARE THE PRIMITIVES IN THE MAN-COMPUTER DIALOGUE. DESIGNING AN EQUALLY EFFECTIVE SYSTEM FOR EITHER A BROADER RANGE OF TASKS OR A BROADER RANGE OF USER EXPERIENCE LEVELS IS A MUCH MORE DIFFICULT PROBLEM. THIS PARTICULAR SYSTEM, NOW KNOWN AS THE CULLER-FRIED SYSTEM, HAS NONETHELESS BEEN QUITE INFLUENTIAL IN THE INTERACTIVE SYSTEMS COMMUNITY.

172 STANDARDS FOR PROPERTIES OF TERMINALS
FUJAROS, R.G. (ED.) DATA TERMINAL STANDARDS AND PROTOCOLS (REPORT NO. CRC1275). OTTAWA, ONTARIO, CANADA: DEPARTMENT OF COMMUNICATIONS, COMMUNICATIONS
RESEARCH CENTRE, APRIL 1975. (NTIS NO. N75-29298)
DESCRIPTION:

AVAILABLE STANDARDS AND PROTOCOLS APPLICABLE TO THE DESIGN AND USE OF INTERACTIVE DATA COMMUNICATION TERMINALS AND ASSOCIATED EQUIPMENT ARE IDENTIFIED, CLASSIFIED AND CATALOGUED WITH RESPECT TO THE OPERATOR AND COMMUNICATION LINE INTERFACES OF THE TERMINAL. THE UTILITY AND INFLUENCE OF, AND ADHERENCE TO, PUBLISHED AND UNPUBLISHED STANDARDS AND PROTOCOLS ARE ASSESSED. MAJOR INFLUENCING FACTORS IN THEIR DEVELOPMENT AND USE AND THE CURRENT TRENDS IN THEIR EVOLUTION ARE PRESENTED. PARTICULAR EMPHASIS IS PLACED ON THOSE STANDARDS AND PROTOCOLS AVAILABLE WORLDWIDE WHICH ARE LIKELY TO HAVE MOST IMPACT WITHIN CANADA. (A) 113P, 55R.

COMMENTS:

THIS REPORT BRINGS TOGETHER IN ONE PLACE THE STANDARDS FOR INTERACTIVE TERMINALS THAT HAVE BEEN PROPOSED BY INTERNATIONAL ORGANIZATIONS, MANUFACTURERS' ASSOCIATIONS AND USERS' ASSOCIATIONS. THIS REPORT IS, THEREFORE, AN EXCELLENT SOURCE DOCUMENT FOR ANYONE INTERESTED IN THE STANDARDS ESTABLISHED FOR A PARTICULAR ASPECT OF INTERACTIVE TERMINALS AND ASSOCIATED PERIPHERAL DEVICES AND HARDWARE INTERFACES. ASPECTS FOR WHICH STANDARDS DO NOT EXIST, BUT FOR WHICH USERS EXPRESS A DESIRE FOR STANDARDIZATION, ARE ALSO IDENTIFIED. THIS REPORT WOULD BE OF INTEREST PRIMARILY TO THOSE CONCERNED WITH THE PHYSICAL PROPERTIES OF INTERACTIVE TERMINALS. THERE ARE NO DISCUSSIONS OF HUMAN FACTORS IN THE DETERMINATION OF STANDARDS.

DESIGN OF COMPUTERIZED PROBLEM-SOLVING AIDS GAGLIARDI, U.O. DEVELOPMENT OF A MAN-COMPUTER SYSTEM FOR SOLVING A TARGETING PROBLEM. DARIEN, CONNECTICUT: DUNLAP AND ASSOCIATES, INC., 1964. (NTIS NO. AD 607520)

DESCRIPTION:

THIS STUDY WAS CONDUCTED TO DEVELOP A METHOD FOR THE DESIGN OF COMPUTERIZED PROBLEM-SOLVING AIDS. THE METHOD RELIES ON THE OBSERVATION OF PROBLEM-SOLVING BEHAVIOR AND UTILIZES THE EVIDENCES OF HEURISTIC PROCEDURES DISPLAYED BY THE SUBJECT AS INDICATORS OF PROCESSING OVERLOADS. THIS INFORMATION IS, IN TURN, USED TO FORMULATE PROBLEM-SOLVING AIDS WHOSE EFFECTIVENESS IS VERIFIED EXPERIMENTALLY.

EXPERIMENTS INDICATED THAT THE SUBJECT'S PROCESSING LIMITATIONS RESULTED IN A SLOW AND BIASED SEARCH FOR ELEMENTS FOR WHICH TO ASSEMBLE SOLUTIONS. THE AIDED SYSTEM DELEGATED THE SUBTASK OF FINDING KEY ELEMENTS TO AN AUTOMATED PROCESS AND LET THE PERSON ASSEMBLE THESE ELEMENTS INTO DEPLOYMENTS. THE EFFECTIVENESS OF THIS ARRANGEMENT WAS SHOWN BY THE FACT THAT AIDED SUBJECTS FOUND MORE SOLUTIONS AND MORE UNIFORMLY DISTRIBUTED

THAT AIDED SUBJECTS FOUND MORE SOLUTIONS AND MORE UNIFORMLY DISTRIBUTED SOLUTIONS THAN UNAIDED SUBJECTS. (A, ABBR.) 22P, 2R.

COMMENTS:

THIS IS A CONDENSED, PRELIMINARY WERSION OF U.O. GAGLIARDI, R.A. HUSSEY, I.T. KAPLAN, AND R.J. MATTEIS (1965).

174 DESIGN OF COMPUTERIZED PROBLEM-SOLVING AIDS
GAGLIARDI, U.O., HUSSEY, R.A., KAPLAN, I.T., & MATTEIS, R.J. MAN-COMPUTER
INTERACTIONS IN IDEALIZED TACTICAL PROBLEM SOLVING (FINAL REPORT, CONTRACT
NONR-3602(DD)). DARIEN, CONNECTICUT: DUNLAP AND ASSOCIATES, INC., MAY 1965.
(NTIS NO. AD 618707)
DESCRIPTION:

THE AIM OF THIS RESEARCH WAS TO DEVELOP A METHOD FOR THE DESIGN OF AUTOMATED PROBLEM-SOLVING AIDS. THE APPROACH TAKEN WAS TO EXAMINE HUMAN PERFORMANCE FOR EVIDENCE OF INADEQUATE HEURISTIC PROCEDURES INDICATING PROCESSING OVERLOADS WHICH COULD BE ELIMINATED BY APPROPRIATE AUTOMATED PROCEDURES.

THE PROCEDURES USED WERE SELECTED BECAUSE THEY HAVE A FORMAL STRUCTURE WHICH ADMITS MANY INTERPRETATIONS -- FROM THE DESIGN OF MINIMAL SWITCHING CIRCUITS TO THE DISPOSITION OF WEAPON SYSTEMS. THE SUBJECT'S TASK WAS TO ALLOCATE HYPOTHETICAL MISSILE-FIRING SUBMARINES SO THAT A SPECIFIED NUMBER OF TARGETS WAS COVERED, BY THE FEWEST POSSIBLE SHIPS. THIS TASK COULD BE FORMULATED AS A LINEAR INTEGER PROGRAMMING PROBLEM WHICH WAS SOLVABLE BY GOMORY'S ALGORITHM. HOWEVER, COMPLETE AUTOMATION OF THE TASK, USING THIS ALGORITHM, WAS UNDESIRABLE, BECAUSE THE PROCEDURE WAS EXCESSIVELY TIME—CONSUMING WHEN MORE THAN A FEW SOLUTIONS WERE REQUIRED.

EXPERIMENTS INDICATED THAT THE SUBJECT'S PROCESSING LIMITATIONS RESULTED IN A SLOW AND BIASED SEARCH FOR ELEMENTS FROM WHICH TO ASSEMBLE SOLUTIONS. THE AIDED SYSTEM DELEGATED THE SUBTASK OF FINDING KEY ELEMENTS TO AN AUTOMATED PROCESS AND LET THE PERSON ASSEMBLE THESE ELEMENTS INTO DEPLOYMENTS. THE EFFECTIVENESS OF THIS ARRANGEMENT WAS SHOWN BY THE FACT THAT AIDED SUBJECTS FOUND MORE AND MORE UNIFORMLY DISTRIBUTED SOLUTIONS THAN UNAIDED SUBJECTS.

IN ORDER TO FURTHER TEST AND DEVELOP AUTOMATED PROBLEM-SOLVING AIDS, WE HAVE DEVELOPED AN OPERATING SYSTEM WHICH ALLOWS EXPERIMENTATION WITH DYNAMIC TASKS. A SIMPLE EXAMPLE OF SUCH A TASK IS PRESENTED IN THE REPORT.

82P, 3R.

THE METHOD FOR DESIGNING AUTOMATED PROBLEM SOLVING AIDS PROPOSED IN THIS PAPER APPEARS TO BE BOTH EFFECTIVE AND EASILY IMPLEMENTED. IN MANY PROBLEM SOLVING SITUATIONS, THE PROCESSING LOAD IMPOSED BY THE TASK EXCEEDS THE RESOURCES AVAILABLE TO THE PROBLEM SOLVER. BY DETERMINING WHICH ASPECTS OF THE TASK IMPOSE THE GREATEST DEMAND FOR THESE RESOURCES, THE TYPE OF PROBLEM SOLVING AID THAT WOULD BE MOST EFFECTIVE CAN BE DETERMINED. THIS PAPER ALSO REPORTS AN EXPERIMENT WITH PROBLEM SOLVING IN A TIME STRESSED SITUATION. THE TWO PRINCIPAL RESULTS WERE THAT STRESS REDUCES PROBLEM SOLVING ABILITY AND THAT SUBJECTS BECOME OVERLY DEPENDENT ON THE PROBLEM SOLVING AID. WHILE THESE RESULTS ARE NOT SURPRISING, THEY DO INDICATE A POTENTIAL PROBLEM WITH SUCH AIDS. WHILE IT IS RELATIVELY SIMPLE TO DEVELOP A PROBLEM SOLVING AID TO PRODUCE OPTIMAL DECISIONS IN THE TASK USED IN THIS EXERIMENT, SUCH SOLUTIONS MAY NOT BE ATTAINABLE WHEN TIME IS LIMITED. IN THIS CASE, AN ACCEPTABLE, BUT NOT NECESSARILY OPTIMAL, DECISION SHOULD BE SOUGHT. THIS IS AN AREA IN WHICH ADDITIONAL RESEARCH IS NEEDED.

175 AIDS FOR RESOURCE ALLOCATION PROBLEM SOLVING GAGLIARDI, U.O., KAPLAN, I., & VALLERIE, L.L. MAN-COMPUTER SYSTEMS AND ALLOCATION OF RESOURCES PROBLEMS (PROGRESS REPORT NO. 3). DARIEN, CONNECTICUT: DUNLAP AND ASSOCIATES, INC., JANUARY 1964. (NTIS NO. AD 430035) DESCRIPTION:

THE WORK REPORTED CONCERNS THE OBSERVATION OF PROBLEM-SOLVING BEHAVIOR EXHIBITED BY SUBJECTS WHO WERE GIVEN AN ALLOCATION-OF-RESOURCES TASK. THE TASK WAS TO DEPLOY POLARIS-LIKE WEAPON SYSTEMS AGAINST A GIVEN TARGET SYSTEM UNDER STATED COMSTRAINTS. WHILE THE TASK IS FORMULABLE AS AN INTEGER LINEAR PROGRAMMING PROBLEM, THE SUBJECTS SOLVED IT BY RESORTING TO HEURISTIC PROCEDURES. THESE PROCEDURES, AS WELL AS THE SOLUTIONS PRODUCED, SEEM TO INDICATE THAT A PROBLEM SOLVER MAY ENCOUNTER CONSIDERABLE DIFFICULTY IN UNCOVERING THE ORDERING OF DECISION ALTERNATIVES, IF THIS ORDERING IS A PARTIAL ONE.

FOLLOWING THE STUDY OF UNAIDED PERFORMANCE, TWO DISTINCT COMPUTER-AID CONCEPTS WERE DEVELOPED AND TESTED. (A)
75P. 10R.

COMMENTS:

THIS PAPER DESCRIBES A PILOT EXPERIMENT FOR A STUDY REPORTED BY U.O. GAGLIARDI, R.A. HUSSEY, I.T. KAPLAN, AND R.J. MATTEIS (1965). THE EXPERIMENTAL METHODS AND RESULTS ARE VERY SIMILAR AND THE INTERESTED READER SHOULD CONSULT THE LATER PAPER.

176 COMPUTER FACILITY LAYOUT
GALITZ, W.O., & LASKA, T.J. COMPUTER SYSTEM PERIPHERALS AND THE OPERATOR.
COMPUTER DESIGN, AUGUST 1969, 8(8), 52-56.
DESCRIPTION:

LITTLE EFFORT HAS BEEN DIRECTED TOWARD INCREASING OUR UNDERSTANDING OF THE ROLE OF THE OPERATOR IN THE COMPUTER SYSTEM, BUT OBSERVING, MEASURING, AND UNDERSTANDING HIS BEHAVIOR IS ESSENTIAL IF WE ARE TO DEVELOP SYSTEMS ENGINEERED FOR HUMANS. SURPRISINGLY, LITTLE RELEVANT DATA IS AVAILABLE. TO DEVELOP A MORE EFFICIENT OPERATING ENVIRONMENT, WE MADE A STUDY OF THE COMPUTER OPERATOR'S RELATIONSHIP TO PERIPHERALS. THE HIGHLIGHTS OF THAT STUDY ARE PRESENTED HERE. (A, ABBR.) 5P, 2R.

COMMENTS:

UNDERSTANDING A USER'S TASK IS A NECESSARY PREREQUISITE TO DESIGNING AN EFFECTIVE WORK ENVIRONMENT. THIS PAPER IS PRIMARILY CONCERNED WITH THE JOB FUNCTIONS AND PHYSICAL ACTIVITIES OF COMPUTER OPERATORS. FAIRLY EXTENSIVE DATA WERE COLLECTED THROUGH QUESTIONNAIRES AND THROUGH ACTIVITY ANALYSIS AND LINK ANALYSIS THAT HAVE BEEN USED EXTENSIVELY BY A. CHAPANIS AND HIS COLLEAGUES. BASED ON THESE DATA, THE AUTHORS MAKE SOME SUGGESTIONS FOR EQUIPMENT LAYOUT THAT SHOULD FACILITATE COMPUTER OPERATORS. THE DATA COLLECTION TECHNIQUES, HOWEVER, ARE APPROPRIATE FOR A BROAD RANGE OF TASKS.

177 COMPUTER FACILITY DESIGN
GALITZ, W.D., & LASKA, T.J. THE COMPUTER OPERATOR AND HIS ENVIRONMENT.
HUMAN FACTORS, 1970, 12, 563-573.

DESCRIPTION:

TO DEVELOP AN INCREASED UNDERSTANDING OF THE FUNCTIONING OF THE COMPUTER OPERATOR AND HOW HE CONTRIBUTES TO TOTAL COMPUTER SYSTEM FUNCTIONING, OPERATOR PERFORMANCE DATA WERE COLLECTED AT A SAMPLE OF SIX CUSTOMER CENTERS USING THE UMIVAC 110B AND 494 COMPUTER SYSTEMS. IN ADDITION, QUESTIONNAIRES WERE SENT TO ALL CUSTOMER PERSONNEL USING THESE SYSTEMS. DATA WERE COLLECTED ON THE PROPORTION OF TIME OPERATORS SPEND AT VARIOUS SYSTEM ACTIVITIES, THE FREQUENCY OF USAGE OF DIFFERENT EQUIPMENT WITHIN THE COMPUTER CENTER, AND THE FREQUENCY OF OPERATOR MOVEMENT BETWEEN SYSTEM COMPONENTS. REPORTED OPERATOR INFORMATION REQUIREMENTS ARE SUMMARIZED, AS ARE OPERATOR BIOGRAPHICAL DATA. A SUGGESTED COMPUTER CENTER LAYOUT IS PRESENTED BASED UPON THE COLLECTED DATA. (A)

COMMENTS:

THIS PAPER SUGGESTS HOW ACTIVITY ANALYSES, LINK ANALYSES, AND RELATED ANALYTICAL TECHNIQUES CAN BE USED TO ASSIST IN THE DEVELOPMENT OF BETTER COMPUTER FACILITY LAYOUTS. COMPUTER FACILITIES HAVE CHANGED SIGNIFICANTLY SINCE THIS STUDY WAS PERFORMED, AND THE PARTICULAR RESULTS REPORTED HERE SHOULD NOT BE ASSUMED TO APPLY TODAY. THE METHOD, HOWEVER, IS THE REAL POINT OF THE PAPER. THOSE CONCERNED WITH THE LAYOUT OF COMPUTER FACILITIES COULD BENEFIT GREATLY FROM THIS PAPER IF THEY ARE NOT FAMILIAR WITH THESE TECHNIQUES. THE AUTHORS ALSO MAKE A FEW INTERESTING OBSERVATIONS WITH RESPECT TO CHARACTERISTICS OF GOOD AND BAD COMPUTER OPERATORS, AND WITH RESPECT TO THE CUES USED BY OPERATORS TO MONITOR MACHINE FUNCTION.

178 DISPLAY RESOLUTION
GARDNER, J.A., & SOLIDAY, S.M. HUMAN FACTORS IN DIGITAL TELECOMMUNICATIONS.
HUMAN FACTORS, 1974, 16, 146-153.
DESCRIPTION:

TO ASSURE MAXIMUM EFFECTIVENESS, DIGITAL SYSTEM DESIGN PARAMETERS MUST BE CHOSEN TO OPTIMIZE HUMAN PERCEPTION. AN EXPERIMENTAL METHODOLOGY IS DESCRIBED WHICH RELATES HUMAN VISUAL PERFORMANCE AND ELECTRONIC DESIGN PARAMETERS. THESE RELATIONSHIPS ARE THEN USED TO SHOW HOW TO SPECIFY OPTIMAL ENCODER DESIGN PARAMETERS. TO ILLUSTRATE THIS EXPERIMENTAL PROCEDURE, TRADEDFFS WERE DETERMINED FOR A DIGITALLY ENCODED TELEVISION SYSTEM. THESE RELATIONSHIPS WERE DETERMINED BY MEASURING SUBJECTS' MINIMUM PERCEPTIBLE ACUITIES FOR VARIOUS LENGTH LINES AND SPATIAL ORIENTATIONS. VISUAL PERFORMANCE WAS DETERMINED FOR POINTS ALONG FOUR NOISE-BANDWIDTH CURVES REPRESENTING DIFFERENT INFORMATION CAPACITIES AND SYSTEM COSTS. OPTIMUM SYSTEM PERFORMANCE WAS ACHIEVED BY MAXIMIZING THE SAMPLING FREQUENCY (BANDWIDTH) OF THE ENCODER. (A)

SP, 7R.

THIS IS A WELL EXECUTED EXPERIMENT WHICH RELATES VISUAL ACUITY TO BANDWIDTH AND SIGNAL-TO-NOISE RATIO IN A DIGITAL TELEVISION DISPLAY. THE DATA DERIVED BY THIS EXPERIMENT ARE POTENTIALLY USEFUL FOR DISPLAY DESIGN OR SELECTION, BUT MUST BE USED WITH CARE. TO USE THESE DATA, ONE MUST TAKE INTO ACCOUNT THE VISUAL ACUITY REQUIREMENTS OF THE PARTICULAR VISUAL TASK FOR WHICH THE DISPLAY WILL BE USED. ESPECIALLY IN COMPUTER DISPLAYS (AS CONTRASTED WITH MORMAL PICTORIAL TV DISPLAYS), THESE ACUITY REQUIREMENTS VARY GREATLY. IN ANY EVENT, THE EXPERIMENTAL METHOD EMPLOYED HERE COULD EASILY BE USED IN THE CONTEXT OF THE PARTICULAR VISUAL TASK FOR WHICH THE DISPLAY IS INTENDED.

179 ALPHANUMERIC RASTER DISPLAYS

GIDDINGS, B.J. ALPHA-NUMERICS FOR RASTER DISPLAYS. ERGONOMICS, 1972, 15, 65-72.

DESCRIPTION:

THE POSSIBILITY OF USING SMALL TV TYPE RASTER DISPLAYS IN AIRBORNE APPLICATIONS RAISES MANY PROBLEMS. ONE OF THESE IS THE SIZE OF ALPHA-NUMERIC CHARACTERS. A LEGIBILITY EXPERIMENT IS DESCRIBED WHICH SUGGESTS THAT UNDER PARTICULAR CONDITIONS THERE IS AN OPTIMUM HEIGHT FOR CHARACTERS. THIS OPTIMUM HEIGHT WAS FOUND TO BE DIFFERENT FOR SIX-LETTER WORDS AND SINGLE DIGITS. (A)

AN AIRCRAFT PILOT IS CONFRONTED WITH A LARGE NUMBER OF RELATIVELY SMALL INSTRUMENTS (DISPLAYS). ONE TECHWIQUE FOR INCREASING THE AMOUNT OF INFORMATION THAT CAN BE CONVEYED BY AN INSTRUMENT IS TO "TIME-SHARE" DISPLAY SURFACES. THIS CAN BE ACCOMPLISHED BY USING A TV-TYPE RASTER DISPLAY. THIS RESEARCH IS DIRECTED AT DETERMINING THE RELEVANT PARAMETERS FOR SUCH DISPLAYS.

8P, 9R.

COMMENTS:

TIME-SHARING DISPLAY SURFACES IS AN INTERESTING, AND POSSIBLY VERY USEFUL, IDEA. THIS PAPER REPORTS AN EXPERIMENT CONCERNED WITH FINDING THE OPTIMUM CHARACTER HEIGHT FOR SUCH DISPLAYS. THE RESULTS OF THIS EXPERIMENT ARE CLEARLY PRESENTED AND COULD PROBABLY BE APPLIED TO ANY TYPE OF RASTER-SCAN DISPLAY. AS THE AUTHOR NOTES, THERE ARE SEVERAL AREAS THAT MUST BE CONSIDERED IN DEVELOPING TIME-SHARED DISPLAYS. THESE AREAS INCLUDE THE EFFECTS OF LOSS OF POSITION CODING, DETERMINING WHAT INFORMATION CAN BE TIME-SHARED, AND PROVIDING AN EFFICIENT MEANS FOR THE OPERATOR TO CONTROL THE DISPLAY. THIS PAPER WOULD BE OF INTEREST TO THOSE CONCERNED WITH ALPHANUMERIC DISPLAYS AND IT CONTAINS SOME INTERESTING IDEAS THAT WOULD BE RELEVANT TO ANYONE INTERESTED IN TIME-SHARED DISPLAYS.

180 DATA ENTRY

GILB, T., & WEINBERG, G. HUMANIZING DATA ENTRY BY DEFAULT. DATAMATION, AUGUST 1976, 22(8), 73-76.

DESCRIPTION:

ALTHOUGH HARDWARE AND SOFTWARE TECHNOLOGY HAVE GREATLY IMPROVED IN THE PAST TWENTY YEARS, INPUT DESIGN HAS LARGELY BEEN NEGLECTED. WE STILL EMPLOY LARGE NUMBERS OF KEYPUNCH OPERATORS TO MANUALLY "VERIFY" INPUT EVEN THOUGH THE TECHNOLOGY EXISTS FOR CHEAPER, FASTER, AND EASIER INPUT. THE USE OF INPUT DEFAULTS ALONE COULD GREATLY IMPROVE THE SPEED AND ACCURACY OF DATA ENTRY.

4P, OR.

COMMENTS:

THE AUTHORS ARE QUITE CORRCT IN NOTING THAT DEFAULTS ARE FREQUENTLY USED IN INTERPERSONAL COMMUNICATION. IF WE KNOW THAT THE RECIPIENT OF A MESSAGE ALREADY POSSESSES CERTAIN INFORMATION, WE DO NOT NEED TO EXPLICITLY INCLUDE THAT INFORMATION IN OUR MESSAGE. THE SUCCESS OF COMMUNICATION IN WHICH INFORMATION IS DEFAULTED DEPENDS ON THE ABILITY OF THE RECIPIENT OF THE MESSAGE TO INFER THE DEFAULTED INFORMATION. BOTH THE SCOPE AND DIFFICULTY OF THIS ISSUE ARE MUCH MORE COMPLICATED THAN IS IMPLIED IN THIS PAPER. ALTHOUGH THE USE OF INPUT DEFAULTS SHOULD BE VERY USEFUL IN CERTAIN TYPES OF SITUATIONS, IT COULD BE EXTREMELY DETRIMENTAL IN OTHER SITUATIONS. A CAREFUL ANALYSIS OF A GIVEN SITUATION IS REQUIRED BEFORE INPUT DEFAULT IS INTRODUCED. ALTHOUGH THIS PAPER DOES NOT PRESENT A RIGOROUS TREATMENT OF THIS ISSUE, IT DOES CONTAIN SOME IDEAS THAT SHOULD BE OF INTEREST TO THOSE CONCERNED WITH DATA ENTRY PROCEDURES.

#### 181 TIME-SHARING

GOLD, M.M. A METHODOLOGY FOR EVALUATING TIME-SHARED COMPUTER SYSTEM USAGE. UNPUBLISHED DOCTORAL DISSERTATION, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASSACHUSETTS, JUNE 1967.

ESCRIPTION:

THE DEVELOPMENT OF TIME-SHARED COMPUTER SYSTEMS HAS LED TO MAJOR TECHNICAL AND PHILOSOPHIC CHANGES IN THE COMPUTER FIELD THIS DECADE. A LARGE NUMBER OF DESIGNERS, MANUFACTURERS, AND USERS OF SUCH SYSTEMS HAVE EXPENDED GREAT AMOUNTS OF EFFORT IN THE DEVELOPMENT OF THE CAPABILITIES OF THE COMPUTER AND THE MEANS TO USE IT. HOWEVER, LITTLE OR NO EFFORT HAS YET BEEN EXPENDED TO EVALUATE THESE SYSTEMS IN TERMS OF THEIR USEFULNESS FOR PRESENT OR FUTURE CUSTOMERS.

THE RESEARCH REPORTED HERE HAS FOCUSED ON THE DEVELOPMENT OF A METHODOLOGY THROUGH WHICH TIME-SHARED COMPUTER SYSTEM USAGE CAN BE EVALUATED. IT IS BASED ON A STUDY OF THE CHARACTERISTICS AND DESIGN OF PRESENT AND PROPOSED COMPUTER SYSTEMS, AS WELL AS RELEVANT BEHAVIORAL THEORY AND RESEARCH. FOUR CATEGORIES OF VARIABLES ARE INCLUDED IN THE RESULTING METHODOLOGY, NAMELY THOSE WHICH ARE MEASURES OF: (1) THE COST OF USING THE SYSTEM, (2) THE PERFORMANCE PRODUCED THROUGH USE OF THE COMPUTER SYSTEM, (3) THE SPEED WITH WHICH RESULTS COULD BE PRODUCED, AND (4) THE AMOUNT OF LEARNING RESULTING FROM THE USE OF THE COMPUTER SYSTEM.

LEARNING RESULTING FROM THE USE OF THE COMPUTER SYSTEM.

THE METHODOLOGY DEVELOPED WAS TESTED EXPERIMENTALLY THROUGH EVALUATING USAGE OF TWO COMPUTER SYSTEMS, EACH EXHIBITING CERTAIN CHARACTERISTICS OF BOTH TIME-SHARING AND BATCH-PROCESSING. THE PRIMARY PROBLEM UNDER STUDY WAS THE EFFECT OF RAPID FEEDBACK AND UNLIMITED COMPUTER ACCESS IN A PROBLEM-SOLVING SITUATION -- THE SECONDARY INVESTIGATION INVOLVED THE EFFECT OF QUALITATIVELY DIFFERENT FEEDBACK UPON COMPUTER PROGRAMMING. (A) 152P, 87R.

COMMENTS:

THIS PAPER REPORTS ON TWO EXPERIMENTS. THE FIRST COMPARED BATCH PROCESSING AND TIME-SHARING USING THE "DYNAMO" PROGRAMMING LANGUAGE AND THE SECOND COMPARED TWO PROGRAMMING LANGUAGES (FORTRAN II AND FOREGO). THESE EXPERIMENTS APPEAR TO HAVE BEEN CAREFULLY CONDUCTED AND ARE CLEARLY REPORTED. AT THE TIME THIS PAPER WAS WRITTEN, A GREAT DEAL OF ATTENTION WAS BEING GIVEN TO THE RELATIVE ADVANTAGES OF TIME-SHARED AND BATCH SYSTEMS. THIS PAPER REPRESENTS THE FIRST ATTEMPT TO EVALUATE SUCH SYSTEMS USING NON-PROGRAMMERS AS SUBJECTS; THAT IS, THESE EXPERIMENTS COMPARED TIME-SHARED AND BATCH SYSTEMS AS PROBLEM SOLVING OR DECISION MAKING AIDS RATHER THAN AS PROGRAMMING TOOLS. THIS IS, PERHAPS, THE MOST IMPORTANT CONTRIBUTION MADE BY THIS PAPER. THE PAPER ALSO ADVANCES SEVERAL HYPOTHESES WHICH HAVE SUBSEQUENTLY RECEIVED ATTENTION FROM RESEARCHERS. THIS PAPER SHOULD BE OF INTEREST TO THOSE CONCERNED WITH EVALUATING TIME-SHARED SYSTEMS AND IT CONTAINS SEVERAL USEFUL IDEAS FOR ADDITIONAL RESEARCH IN THIS AREA.

182 TIME-SHARING VERSUS BATCH PROCESSING

GOLD, N.M. TIME-SHARING AND BATCH-PROCESSING: AN EXPERIMENTAL COMPARISON OF THEIR VALUES IN A PROBLEM-SOLVING SITUATION. COMMUNICATIONS OF THE ACM, 1969, 12, 249-259.

DESCRIPTION:

AN EXPERIMENTAL COMPARISON OF PROBLEM-SOLVING USING TIME-SHARING AND BATCH-PROCESSING COMPUTER SYSTEMS CONDUCTED AT MIT IS DESCRIBED IN THIS PAPER. THIS STUDY IS THE FIRST KNOWN ATTEMPT TO EVALUATE TWO SUCH SYSTEMS FOR WHAT MAY WELL BE THE PREDOMINANT USER POPULATION WITHIN THE NEXT DECADE -- THE PROFESSIONALS WHO, AS NONPROGRAMMERS, ARE USING THE COMPUTER AS AN AID IN DECISION-MAKING AND PROBLEM-SOLVING RATHER THAN AS A PROGRAMMING END IN ITSELF.

STATISTICALLY AND LOGICALLY SIGNIFICANT RESULTS INDICATE EQUAL COST FOR USAGE OF THE TWO COMPUTER SYSTEMS; HOWEVER, A MUCH HIGHER LEVEL OF PERFORMANCE IS ATTAINED BY TIME-SHARING USERS. THERE ARE INDICATIONS THAT SIGNIFICANTLY LOWER COSTS WOULD HAVE RESULTED IF THE TIME-SHARING USERS HAD STOPPED WORK WHEN THEY REACHED A PERFORMANCE LEVEL EQUAL TO THAT OF THE BATCH USERS. THE USERS' SPEED OF PROBLEM-SOLVING AND THEIR ATTITUDES MADE TIME-SHARING THE MORE FAVORABLE SYSTEM. (A) 11P, 28R.

COMMENTS:

THIS PAPER PRESENTS A RE-ANALYSIS OF AN EXPERIMENT COMPARING TIME-SHARING AND BATCH PROCESSING THAT WAS ORIGINALLY REPORTED IN M.M. GOLD (1967). THIS DESCRIPTION DIFFERS FROM THE EARLIER PAPER PRIMARILY IN THAT THE DATA ARE ANALYZED MORE THOROUGHLY. THOSE INTERESTED IN THIS SPECIFIC EXPERIMENT ARE REFERRED TO THE PRESENT PAPER; THOSE WISHING A MORE DETAILED DESCRIPTION OF THE RATIONALE UNDERLYING THIS EXPERIMENT SHOULD CONSULT THE EARLIER DESCRIPTION.

183 MAN-COMPUTER PROBLEM SOLVING

GOLDSTEIN, R.C. HELPING PEOPLE THINK (REPORT NO. MAC-TM-25), CAMBRIDGE, MASSACHUSETTS: MASSACHUSETTS INSTITUTE OF TECHNOLOGY, PROJECT MAC, APRIL 1971 (ALSO PUBLISHED IN NAVAL RESEARCH REVIEWS, JANUARY 1971, 24(1), 1-10). (NTIS NO. AD 721998)

DESCRIPTION:

EVERYONE, TODAY, IS FAMILIAR WITH THE USE OF MACHINES TO EASE PHYSICAL BURDENS. SINCE THE DAWN OF CIVILIZATION, MAN'S PROGRESS IN GAINING CONTROL OVER HIS ENVIRONMENT HAS BEEN LARGELY DETERMINED BY THE POWER AND SOPHISTICATION OF THE MACHINES THAT HE HAS BEEN ABLE TO COMMAND. WHEN GENERAL PURPOSE COMPUTERS FIRST CAME INTO EXISTENCE IN THE YEARS FOLLOWING WORLD WAR II, MANY OPTIMISTIC OBSERVERS FELT THAT THEY WOULD SOON DO FOR MEN'S MENTAL CAPABILITIES WHAT OTHER MACHINES HAD DONE FOR HIS PHYSICAL ONES. WE HAVE NOW PASSED THROUGH THE FIRST TWENTY YEARS OF THE COMPUTER AGE, AND REGRETTABLY, WE DO NOT SEEM TO HAVE MADE MUCH PROGRESS IN AUGMENTING MAN'S ABILITY TO THINK. COMPUTERS HAVE GIVEN MAN MORE TIME TO THINK BY RELIEVING HIM OF MANY HIGHLY REPETITIVE CLERICAL TASKS, AND THEY HAVE ALSO MADE IT EASIER BY PROVIDING RELATIVELY QUICK ACCESS TO LARGE DATA BASES. HOWEVER, EVEN THESE RELATIVELY MEAGER BENEFITS ARE USUALLY AVAILABLE ONLY TO THOSE WILLING TO INTERACT WITH THE COMPUTER ON ITS OWN TERMS. THIS PAPER DISCUSSES AN ON-GOING RESEARCH PROGRAM IN INTERACTIVE PROBLEM SOLVING AND DECISION MAKING. THE GOAL OF THIS PROGRAM IS TO DEVELOP A COMPUTER BASED FACILITY FOR AUGMENTING A MAN'S INTELLECTUAL ABILITY. SUCH A SYSTEM SHOULD PROVIDE POWERFUL' AND WELL HUMAN-ENGINEERED INTERACTIVE AIDS FOR ATTACKING COMPLEX PROBLEMS AND SHOULD AUTOMATICALLY HANDLE ROUTINE ONES. (4, ABBR.)

COMMENTS:

THIS PAPER BRIEFLY DESCRIBES A VERY LARGE SCALE, SOPHISTICATED MAN-COMPUTER SYSTEM FOR A VARIETY OF APPLICATIONS. THE OVERALL SCOPE OF THIS PROJECT IS SIMILAR TO THAT OF THE AUGMENTATION RESEARCH CENTER BEING DEVELOPED AT STANFORD RESEARCH INSTITUTE BY ENGELBART AND HIS COLLEAGUES. THE PROJECT OUTLINED IN THIS PAPER IS VERY AMBITIOUS AND INCORPORATES A NUMBER OF FEATURES TO PROMOTE EASE OF USE BY A VARIETY OF USERS. ALTHOUGH THIS PAPER DOES NOT PROVIDE A DETAILED DESCRIPTION OF THIS SYSTEM, IT DOES OFFER AN EASY-TO-READ INTRODUCTION AND OVERVIEW.

AUTOMATED AIDS FOR PROCESS CONTROL

GOODSTEIN, L.P. A PROCESS INSTRUMENTATION FOR MAN-MACHINE COMMUNICATION
STUDIES. IN PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON MAN-MACHINE SYSTEMS,
3-12 SEPTEMBER 1969 (VOL. 4) (IEEE CONFERENCE RECORD NO. 69C58-MMS). NEW
YORK: INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS, 1969.
DESCRIPTION:

IN THE EFFORT TO FACILITATE THE MAN-MACHINE COMUNICATION IN ADVANCED PROCESS CONTROL SYSTEMS A SEVERE NEED IS FELT FOR EXPERIMENTAL RESULTS IN REAL PLANT ENVIRONMENT TO SUPPLEMENT RESULTS FROM PSYCHOLOGICAL LABORATORIES. THEREFORE, AN INSTRUMENTATION SYSTEM HAS BEEN DEVELOPED FOR ONE OF THE DANISH ATOMIC ENERGY'S RESEARCH REACTORS AS PART OF AN EXPERIMENT ON THE ADVANTAGES TO BE GAINED BY THE USE OF DIGITAL COMPUTERS IN A PROCESS PLANT APPLICATION. ONE OF THE MAJOR OBJECTIVES OF THIS EXPERIMENT IS THE INVESTIGATION OF THE FUNCTIONING OF THE HUMAN IN HIS ROLE AS PROCESS OPERATOR WITH THE ULTIMATE AIM OF UTILIZING THE CAPABILITIES OF THE INSTRUMENTATION TO ASSIST, COMPLEMENT AND GENERALLY IMPROVE HIS PERFORMANCE ON AN INTERACTIVE BASIS. THEREFORE, CONSIDERABLE EFFORTS HAVE BEEN EXPENDED IN THE SYSTEM'S DISPLAY AND CONTROL CAPABILITIES —BOTH HARDWARE AND SOFTWARE —TO PROVIDE A FLEXIBLE AND EFFECTIVE FACILITY ON WHICH TO CARRY OUT THESE INVESTIGATIONS. INCLUDED ARE CONVENTIONAL AND STORAGE CRT DISPLAYS, DIGITAL AND STATUS INDICATORS, LIGHTPEN AND KEYBOARD ARRAYS ALL INTEGRATED INTO AN EFFICIENT AND COMPACT CONTROL CONSOLE. THE SYSTEM WILL BE DESCRIBED AND PRACTICAL EXPERIENCE TO DATE GIVEN. (A) 14P. 5R.

14P, 5R.

THIS PAPER DESCRIBES AN EXPERIMENTAL CONTROL CONSOLE FOR A PROCESS CONTROL TASK BUT DOES NOT DESCRIBE ANY EXPERIMENTS PERFORMED WITH THIS CONSOLE. THERE ARE SOME FAIRLY HIGH-LEVEL DISCUSSIONS OF THE INFORMATION NEEDS OF THE OPERATOR AND THE DESCRIBED CONSOLE APPEARS TO BE FLEXIBLE ENOUGH TO INVESTIGATE VARIOUS TECHNIQUES FOR DISPLAYING THIS INFORMATION. THIS PAPER WOULD BE RELEVANT PRIMARILY TO THOSE INTERESTED IN DISPLAYS FOR PROCESS CONTROL. THIS IS NOT A PETAILED TREATMENT, HOWEVER, OF PROCESS CONTROL AS A TYPE OF INTERACTIME TASK.

185 EMBEDDED TRAINING

GOODWIN, N.C. INTRO: IN WHICH A SMART TERMINAL TEACHES ITS OWN USE (TECHNICAL PAPER MTP-150). BEDFORD, MASSACHUSETTS: MITRE CORP., MARCH 1974.
DESCRIPTION:

THE USE OF PROCESSOR AIDED DISPLAY STATIONS (PADS) CAN BE FACILITATED, ESPECIALLY FOR MOVICE USERS, BY INCORPORATING ON-LINE INSTRUCTIONAL AIDS UNDER CONTROL OF THE STATION PROCESSOR. IN MITRE'S PADS LABORATORY AN INTERACTIVE DISPLAY SEQUENCE CALLED INTRO PROVIDES SUCH GUIDANCE, TEACHING BEGINNERS HOW TO USE THE STATION KEYBOARD AND LIGHTGUN IN CONJUNCTION WITH THE SANDERS 720 DISPLAY. THIS REPORT DESCRIBES THE INTRO SCHEME AND PRESENTS PERFORMANCE DATA FROM SIX PEOPLE WHO USED THE SCHEME FOR TRAINING DURING THE RECENT PADS TEST PROGRAM. (A) 22P, DR.

COMMENTS:

THIS PAPER DESCRIBES A PARTICULAR APPLICATION OF EMBEDDED TRAINING. THE TUTORIAL SYSTEM REPORTED HERE IS SIMPLE AND WELL DONE. THE STATISTICAL DATA REPORTED ARE UNLIKELY TO BE OF MUCH BENEFIT TO THOSE NOT CONCERNED WITH THE PARTICULAR SYSTEM IN WHICH THE EMBEDDED TRAINING PACKAGE WAS USED. THE PAPER DESCRIBES THE TECHNIQUES USED IN THE TUTORZAL PACKAGE IN SOME DETAIL, HOWEVER, AND MAY PROVIDE A USEFUL MODEL FOR OTHERS WHO WANT TO EMPLOY SUCH TECHNIQUES.

185 COMPARISON OF INPUT DEVICES FOR CURSOR POSITIONING GOODWIN, N.C. CURSOR POSITIONING ON AN ELECTRONIC DISPLAY USING LIGHTPEN, LIGHTGUN, OR KEYBOARD FOR THREE BASIC TASKS. HUMAN FACTORS, 1975, 17, 289-295. DESCRIPTION:

THREE BASIC TASKS WERE DESIGNED TO MEASURE HOW FAST A USER COULD POSITION A CURSOR AT VARIOUS LOCATIONS ON AN ELECTRONIC DISPLAY. THE TASKS WERE ARBITRARY CURSOR POSITIONING, SEQUENTIAL CURSOR POSITIONING, AND CHECK-READING FOR ERRORS. THREE CURSOR POSITIONING DEVICES WERE TESTED. BOTH LIGHTPEN AND LIGHTGUN PERMITTED FASTER CURSOR POSITIONING THAN A POORLY DESIGNED KEYBOARD. THESE POINTING DEVICES WERE FOUR TO FIVE TIMES FASTER THAN THE KEYBOARD FOR THE ARBITRARY POSITIONING TASK, AND ABOUT TWICE AS FAST FOR THE OTHER TASKS. (A)

COMMENTS:

THIS STUDY IS ESPECIALLY SUSCEPTIBLE TO THE BASIC METHODOLOGICAL PROBLEM WHICH TENDS TO PLAGUE ALL SUCH STUDIES. THAT IS, IT IS EXTREMELY DIFFICULT TO DETERMINE THE DEGREE TO WHICH THE OBSERVED RESULTS ARE CHARACTERISTIC OF WHOLE CLASSES OF INPUT DEVICES, RATHER THAN SPECIFIC TO THE PARTICULAR DEVICES STUDIED. IN THE CASE OF THIS EXPERIMENT, THE KEYBOARD USED WAS EXTREMELY POORLY DESIGNED FOR THE FUNCTION OF CURSOR CONTROL. IT IS LIKELY THAT SIMILAR RESULTS WOULD BE OBTAINED IF LIGHTPEN DEVICES WERE COMPARED WITH WELL DESIGNED CURSOR CONTROL KEYBOARDS. BOTH ARMCHAIR ANALYSIS AND OTHER (SCANTY) EXPERIMENTAL EVIDENCE INDICATE THAT KEYBOARDS ARE INHERENTLY POOR DEVICES FOR CURSOR POSITIONING. THIS IS OTHERWISE A WELL DESIGNED EXPERIMENT, AND THE TECHNIQUES EMPLOYED FOR MEASURING CURSOR POSITIONING PERFORMANCE ARE VERY GOOD. UNFORTUNATELY, THOUGH, THE EXPERIMENT FAILS TO CONVINCINGLY SETTLE THE QUESTION OF CURSOR CONTROL DEVICE SELECTION FOR HARDWARE OTHER THAN THAT EMPLOYED IN THE STUDY. FOR ITS METHODOLOGY AND GENERAL DISCUSSION, THE PAPER SHOULD INTEREST THOSE CONCERNED WITH THE DESIGN, SELECTION, OR APPLICATION OF SUCH DEVICES.

187 VISUAL FACTORS IN CRT DISPLAYS
GOULD, J.D. VISUAL FACTORS IN THE DESIGN OF COMPUTER-CONTROLLED CRT DISPLAYS.
HUMAN FACTORS, 1968, 10, 359-375.
DESCRIPTION:

THIS PAPER IS CONCERNED WITH THE IMPORTANT DISPLAY VARIABLES THAT DETERMINE IMAGE QUALITY ON COMPUTER-CONTROLLED CRT DISPLAYS. A STRATEGY IS DEVELOPED THAT LEADS TO GENERAL CONCLUSIONS ABOUT EACH VARIABLE EVEN THOUGH MOST OF THESE VARIABLES INTERACT. FOR EACH VARIABLE CONSIDERED, THE RECOMMENDED RANGE OF VALUES IS DETERMINED ON THE BASIS OF EXPERIMENTAL EVIDENCE AND IS COMPARED WITH THE VALUES PRESENTLY USED ON DISPLAYS. WHERE DISCREPANCIES BETWEEN THESE TWO EXIST, ALTERNATIVE SOLUTIONS ARE MENTIONED. CONCLUSIONS ARE (I) PRESENTLY USED VALUES OF DISPLAY LUMINANCE, CHROMATICITY (COLOR), AND RESOLUTION ARE ADEQUATE (II) SEVERAL DISPLAYS FLICKER (III) CHARACTERS ARE LARGE ENOUGH BUT MAY BE MARGINAL IN TERMS OF NUMBER OF ELEMENTS (IV) LUMINANCE CONTRAST IS NOT ADEQUATE. (A) 17P, 85R.

COMMENTS:

THIS IS AN EXCELLENT REVIEW ARTICLE. THE AUTHOR REVIEWS, IN BRIEF AND READABLE FORM, A GOOD DEAL OF RELEVANT EXPERIMENTAL LITERATURE ON THE VISUAL FACTORS INVOLVE IN DISPLAYS. THIS DISCUSSION, WHICH COMPRISES MOST OF THE PAPER, REMAINS QUITE USEFUL TODAY. THE DISCUSSION OF THE PROPERTIES OF SPECIFIC COMMERCIALLY AVAILABLE CRT DISPLAYS IS ALSO WELL DONE, BUT IS NECESSARILY SOMEWHAT DATED NOW. MORE DETAILED TREATMENTS OF VISUAL FACTORS IN DISPLAYS ARE AVAILABLE, BUT THIS IS THE BEST REVIEW WHICH SPECIFICALLY CONCERNS CRT DISPLAYS.

#### 183 QUERY LANGUAGES

GOULD, J.D., & ASCHER, R.N. USE OF AN IRF-LIKE QUERY LANGUAGE BY NON-PROGRAMMERS (RESEARCH REPORT NO. RC-5279). YORKTOWN HEIGHTS, NEW YORK: IBM JATSON RESEARCH CENTER, FEBRUARY 1975 (ALSO PRESENTED AT MEETING OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION, NEW ORLEANS, LOUISIANA, SEPTEMBER 1974). DESCRIPTION:

THIS EXPLORATORY EXPERIMENT ATTEMPTS TO EXAMINE SEPARATELY THE FORMULATION, PLANNING, AND CODING OF QUERIES. COLLEGE STUDENTS AND FILE CLERKS REQUIRED ABOUT TEN HOURS TO LEARN A QUERY LANGUAGE WHICH WAS SOMEWHAT SIMILAR TO IBM'S IQF QUERY LANGUAGE, BUT CONTAINED MORE FUNCTIONS. THEY WERE THEN GIVEN 15 TEST PROBLEMS THAT VARIED IN COMPLEXITY AND HOW WELL THEY WERE EXPRESSED. SUBJECTS WERE REQUIRED TO FORMULATE, THEN TO PLAN (WRITING EACH IN THEIR OWN WORDS), AND FINALLY TO CODE EACH PROBLEM. RESULTS PROVIDE SOME SUGGESTIONS ABOUT WHICH PROBLEM VARIABLES AFFECTED WHICH "STAGES" IN WRITING QUERIES. FOR EXAMPLE, WHETHER OR NOT A PROBLEM WAS WELL EXPRESSED SEEMED TO AFFECT PROBLEM FORMULATION TIME, BUT HAD NO EFFECT UPON PROBLEM PLANNING OR PROBLEM CODING TIMES. SPECIFIC LANGUAGE CONSTRUCTIONS (ADDITIONS TO IQF), SUCH AS CONTEXTUAL REFERENCING AND A NEW METHOD TO HANDLE LIMITED DISJUNCTIVE PROBLEMS, WERE SHOWN TO BE USEFUL. THE TYPES OF CODING ERRORS THAT SUBJECTS MADE WERE IDENTIFIED AND DISCUSSED. (A)

#### COMMENTS:

THIS IS AN INTERESTING DESCRIPTIVE STUDY INTENDED BOTH TO PROVIDE INFORMATION ABOUT QUERY FORMULATION BY NONPROGRAMMERS AND TO EVALUATE FEATURES OF A QUERY LANGUAGE. THE FINDING THAT TIME SPENT IN ALL THREE STAGES OF QUERY CONSTRUCTION INCREASED WITH THE NUMBER OF SETS OF RECORDS REQUIRED AND WITH THE NUMBER OF MODIFIERS APPLIED TO EACH SET IS INFORMATIVE, IF UNSURPRISING, AND HAS IMPLICATIONS FOR THE DESIGN AND USE OF QUERY LANGUAGES IN GENERAL. STUDIES OF THIS SORT CAN ALSO BE USEFUL IN THE DESIGN OF SPECIFIC QUERY LANGUAGES, BUT ANALYSIS OF THE RESULTS IS NECESSARILY SOMEWHAT SUBJECTIVE, AS NO DIRECT COMPARISONS ARE INVOLVED. EXPERIMENTS WHICH EXPLICITLY COMPARE ALTERNATIVE DESIGN FEATURES MAY BE MORE DEFINITIVE, BUT ARE ALSO MORE EXPENSIVE AND TIME-COMSUMING. THE PAPER CONTAINS A LARGE NUMBER OF SPECIFIC OBSERVATIONS ABOUT BEHAVIOR IN THE QUERY DEVELOPMENT PROCESS, AND SHOULD BE OF INTEREST TO THOSE CONCERNED WITH QUERY LANGUAGES.

# 189 PROCEDURE SPECIFICATION

GOULD, J.D., LEWIS, C., & BECKER, C.A. WRITING AND FOLLOWING PROCEDURAL, DESCRIPTIVE, AND RESTRICTED SYNTAX LANGUAGE INSTRUCTIONS (RESEARCH REPORT NO. RC-5943). YORKTOWN HEIGHTS, NEW YORK: IBM WATSON RESEARCH CENTER, APRIL 1976. DESCRIPTION:

TWO EXPLORATORY EXPERIMENTS COMPARED THE WAY PEOPLE (WITH NO EXPERIENCE IN THE USE OF COMPUTING SYSTEMS) WRITE AND CARRY OUT NATURAL LANGUAGE PROCEDURES, NATURAL LANGUAGE DESCRIPTIONS, AND INSTRUCTIONS EXPRESSED IN AN ARTIFICIAL RESTRICTED SYNTAX LANGUAGE. THE RESULTS SUGGEST THAT THERE IS NO SINGLE "NATURAL" WAY THAT PEOPLE WRITE SIMPLE PLANS AND INSTRUCTIONS. SPEED AND ACCURACY OF WRITING WERE ABOUT THE SAME FOR ALL THREE APPROACHES, ALTHOUGH THE LINGUISTIC CHARACTERISTICS DIFFERED GREATLY FROM APPROACH TO APPROACH. WHILE SUBJECTS WERE TOLERANT OF AMBIGUITY BOTH IN WRITING AND IN CARRYING OUT INSTRUCTIONS, THEY OFTEN VOLUNTARILY EMPLOYED RESTRICTED-SYNTAX NOTATION IN THEIR WRITING AFTER BEING EXPOSED TO THE NOTATION. SUBJECTS' ACCURACY IN FOLLOWING DETAILED INSTRUCTIONS WAS NO GREATER THAN THAT IN WRITING THOSE INSTRUCTIONS. (A)

## COMMENTS:

THIS STUDY SUGGESTS THAT INDIVIDUALS LACKING EXPERIENCE WITH COMPUTERS CAN EASILY BE MADE TO WRITE PROTOCOLS IN EITHER PROCEDURAL OR DESCRIPTIVE FORM, BY APPROPRIATE TASK INSTRUCTIONS. THEY ALSO APPEAR TO ADAPT READILY TO THE USE OF AN APPROPRIATE RESTRICTED-SYNTAX LANGUAGE FOR DESCRIBING PROCEDURES. THESE FINDINGS MIGHT SUGGEST THAT EITHER FORM IS USEABLE, IN QUERY SYSTEMS FOR EXAMPLE, ALTHOUGH THE PROCEDURAL DESCRIPTIONS WERE FOUND TO BE LESS OFTEN AMBIGUOUS. IT SHOULD BE NOTED THAT THE SUBJECTS TASK INVOLVED WRITING DESCRIPTIONS OR PROCEDURES FOR ANOTHER HUMAN, AND DID NOT EXPLICITLY REQUIRE DISAMBIGUATION IN ALL INSTANCES.

190 LINE PRINTER OUTPUT FORMATTING
GRACE, G.L. APPLICATION OF EMPIRICAL METHODS TO COMPUTER-BASED SYSTEM DESIGN.
JOURNAL OF APPLIED PSYCHOLOGY, 1966, 50, 442-450.
DESCRIPTION:

THIS STUDY PROVIDES INFORMATION ABOUT THE CLARITY AND USEFULNESS OF PRINTOUT FORMATS DESIGNED FOR USE BY MILITARY NONPROGRAMMER PERSONNEL. THREE PRINTOUT FORMATS CONTAINING THE SAME INFORMATION WERE DESIGNED. VERBAL PRINTOUT FORMAT PRESENTED INFORMATION IN WORDS; DATA BLOCK PRINTOUT FORMAT, IN SETS OF DATA; EIDOFORM PRINTOUT FORMAT IN MAPLIKE FORM. TWENTY-THREE MEN STATIONED AT PHOENIX AIR DEFENSE SECTOR SERVED AS SUBJECTS. IMMEDIATELY FOLLOWING THE EXPERIMENTAL SESSIONS, ATTITUDE INFORMATION WAS COLLECTED IN INDIVIDUAL INTERVIEWS. PRINTOUT FORMATS AND SETS OF INTERPRETATION QUESTIONS WERE COMBINED FOR ANALYSIS USING A LATIN-SQUARE DESIGN. ANALYSIS OF VARIANCE SHOWED EXPERIMENTAL TREATMENT CONDITIONS, PRINTOUT FORMATS, AND PRACTICE EFFECTS TO BE STATISTICALLY SIGNIFICANT. DIFFERENCES DUE TO SEQUENCE AND TEST FORMS WERE NOT SIGNIFICANT. ATTITUDE RESULTS SUPPORTED INFORMATION MEASURE FINDINGS. (A)

BOTH TEST SCORES AND SUBJECT PREFERENCE RATINGS WERE SLIGHTLY HIGHER FOR DATA BLOCK FORMAT THAN FOR VERBAL FORMAT AND BOTH WERE SUPERIOR, ON BOTH TEST SCORES AND PREFERENCE RATINGS, TO EIDOFORM FORMAT.

#### COMMENTS:

THIS PAPER WAS INTENDED TO DEVELOP A METHODOLOGY FOR EMPIRICALLY INVESTIGATING THE EFFECTIVENESS OF PRINTOUT FORMATS AND TO DESCRIBE AN EXPERIMENT USING THIS METHODOLOGY. THE AUTHOR IS QUITE CORRECT IN NOTING THAT PRINTOUT DESIGN IS FREQUENTLY LEFT TO "DESIGNER EXPERIENCE AND CHANCE" AND THAT CONTROLLED RESEARCH COULD LEAD TO THE DEVELOPMENT OF MORE EFFECTIVE PRINTOUT DESIGNS. THE RESEARCH REPORTED IN THIS PAPER, HOWEVER, IS NOT REPORTED CLEARLY ENOUGH TO SATISFY THIS OBJECTIVE. ALTHOUGH THE PRINTOUT FORMATS USED IN THIS EXPERIMENT WERE CAREFULLY CONSTRUCTED AND HAVE SOME INTERESTING PROPERTIES THAT SHOULD BE EXAMINED FURTHER, THIS PAPER DOES NOT ADEQUATELY DESCRIBE THE EXPERIMENT THAT WAS PERFORMED. THE EXPERIMENTAL PROCEDURE AND DESIGN ARE NOT DESCRIBED IN SUFFICIENT DETAIL TO BE READILY COMPREHENSIBLE AND THE APPROPRIATENESS OF THE STATISTICAL ANALYSES IS QUESTIONABLE. THIS PAPER MAY, HOWEVER, PE OF INTEREST TO THOSE CONCERNED WITH THE EFFECTS OF PRINTOUT FORMAT ON USER PERFORMANCE.

#### 191 AUTOMATED SPEECH

GRADY, M.W. ADVANCED SPEECH TECHNOLOGY: THE NATURAL MAN/MACHINE INTERFACE. IN PROCEEDINGS OF THE 1975 INTERNATIONAL CONFERENCE ON CYBERNETICS AND SOCIETY. NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., 1975, 296-299.
DESCRIPTION:

THE AUTOMATIC SPEECH TECHNOLOGIES HAVE ADVANCED TO THE POINT THAT COMMERCIALLY AVAILABLE HARDWARE AND SOFTWARE CAN BE EFFECTIVELY UTILIZED IN A VARIETY OF SYSTEM APPLICATIONS. AN AUTOMATED AND ADAPTIVE CONTROLLER TRAINING SYSTEM, AND A DATA ENTRY/QUERY FEASIBILITY DEMONSTRATION SYSTEM, ARE EXAMPLES OF AREAS PARTICULARLY SUITED TO THE APPLICATION OF SPEECH RECOGNITION AND SYNTHESIS. (A)

THESE TWO SYSTEMS ARE BRIEFLY DESCRIBED IN THIS PAPER.

# COMMENTS:

THIS PAPER INDICATES THAT THE TECHNOLOGY REQUIRED FOR NATURAL SPEECH PROCESSING CURRENTLY EXISTS. A DETAILED DESCRIPTION OF THIS FACT WAS PREVIOUSLY PRESENTED BY T.R. ADDIS (1972). GIVEN THAT THE TECHNOLOGY EXISTS, THE NEXT LOGICAL STEP IS TO DETERMINE THE TYPES OF APPLICATIONS IN WHICH NATURAL SPEECH PROCESSING WOULD BE USEFUL AND THE TECHNICAL AND HUMAN FACTORS PROBLEM AREAS ASSOCIATED WITH SUCH APPLICATIONS. WHILE A FAIRLY COMPREHENSIVE OVERVIEW OF TECHNICAL PROBLEM AREAS HAS BEEN PRESENTED (R. TURN, 1974), HUMAN FACTORS PROBLEM AREAS HAVE NOT BEEN SYSTEMATICALLY EXPLORED. THE PRESENT PAPER DESCRIBES TWO APPLICATION AREAS. THESE SYSTEMS COULD POTENTIALLY BE VERY USEFUL IN CONSIDERING HUMAN FACTORS ISSUES AND MAY REPRESENT SIGNIFICANT IMPROVEMENTS IN MAN-COMPUTER DIALOGUE. THE DESCRIPTIONS OF THESE SYSTEMS, HOWEVER, ARE TOO BRIEF TO ALLOW A MEANINGFUL EVALUATION.

192 ROLE OF HUMAN FACTORS IN COMPUTERS
GRANDA, R.E. SOME CONSIDERATIONS IN DEFINING THE ROLE OF HUMAN FACTORS IN
COMPUTERS. IN R.E. GRANDA & J.M. FINKELMAN (EDS.), THE ROLE OF HUMAN FACTORS
IN COMPUTERS: PROCEEDINGS OF A SYMPOSIUM CO-SPONSORED BY THE METROPOLITAN
CHAPTER OF THE HUMAN FACTORS SOCIETY AND BARUCH COLLEGE, CITY UNIVERSITY OF
NEW YORK. NEW YORK: HUMAN FACTORS SOCIETY, METROPOLITAN CHAPTER, 1977, 130139.

DESCRIPTION:

FOR ANYONE WORKING AS A HUMAN FACTORS SPECIALIST IN THE AREA OF COMPUTERS, THERE MUST ARISE AT ONE TIME OR ANOTHER A NAGGING DOUBT ABOUT THE SIGNIFICANCE OF THE ROLE WHICH THE HUMAN FACTORS PROFESSIONAL PLAYS IN THE DESIGN, IMPLEMENTATION, AND USAGE OF COMPUTERS. THIS ISSUE HAS CROPPED UP WITH SOME FREQUENCY RECENTLY IN THE LITERATURE.

SO IT APPEARS THAT THERE IS GROWING CONCERN IN MANY QUARTERS ABOUT THE

SO IT APPEARS THAT THERE IS GROWING CONCERN IN MANY QUARTERS ABOUT THE LACK OF IMPACT MADE BY HUMAN FACTORS IN THE COMPUTER AREA. IS THIS CONCERN LEGITIMATE? WHAT HAS GIVEN RISE TO THESE FINDINGS? WHAT CAN BE DONE TO ALLEVIATE THESE CONCERNS? (A, ABBR.)

10P, 5R. COMMENTS:

A BASIC PREMISE OF THIS PAPER IS THAT HUMAN FACTORS IS RELEVANT TO COMPUTER SYSTEMS, BUT HUMAN FACTORS IS CURRENTLY NOT EFFECTIVE IN INFLUENCING COMPUTER SYSTEM DEVELOPMENT. AFTER DISCUSSING POSSIBLE CAUSES OF THIS LACK OF EFFECTIVENESS, THE AUTHOR MAKES SEVERAL SUGGESTIONS AS TO WHAT IS NEEDED TO INCREASE EFFECTIVENESS. THESE SUGGESTIONS CENTER AROUND THE NEED TO DEVELOP A QUANTITATIVE DATA BASE TO BE USED IN RELATING HUMAN PERFORMANCE CRITERIA TO COMPUTER SYSTEM OBJECTIVES. THIS PAPER WOULD BE RELEVANT PRIMARILY TO HUMAN FACTORS SPECIALISTS WORKING IN THE AREA OF COMPUTERS.

TIME-SHARING VERSUS BATCH PROCESSING
GRANT, E.E. AN EMPIRICAL COMPARISON OF ON-LINE AND OFF-LINE DEBUGGING
(REPORT NO. SP-2441). SANTA MONICA, CALIFORNIA: SYSTEM DEVELOPMENT CORP., MAY
1966. (NTIS NO. AD 633907)
DESCRIPTION:

THIS PAPER REPORTS THE RESULTS OF AN EXPERIMENT CONDUCTED AT SYSTEM DEVELOPMENT CORPORATION IN 1965 AND EARLY 1966. THE EXPERIMENT COMPARED THE PROGRAM DEBUGGING (CHECKOUT) PERFORMANCE OF PROGRAMMERS USING SOC'S TIME-SHARING SYSTEM (TSS) WITH THE DEBUGGING PERFORMANCE OF PROGRAMMERS USING A SIMULATED CLOSED SHOP. TWELVE PROGRAMMERS PARTICIPATED IN THE STUDY. EACH PROGRAMMER WAS GIVEN TWO PROBLEM STATEMENTS AND WAS ASKED TO WRITE A PROGRAM TO SOLVE EACH. ONE PROBLEM REQUIRED A PROGRAM TO INTERPRET AND SOLVE ALGEBRAIC EQUIATIONS. THE OTHER PROBLEM REQUIRED A PROGRAM TO FIND THE SINGLE PATH THROUGH A 20X20 CELL MAZE REPRESENTED IN THE COMPUTER BY A 400 ENTRY TABLE. SIX SOLUTIONS (PROGRAMS) TO EACH PROBLEM WERE DEBUGGED ON-LINE USING TSS AND SIX WERE DEBUGGED OFF-LINE USING A SIMULATED CLOSED-SHOP SYSTEM WITH A DESK-TO-DESK TURNAROUND TIME OF TWO HOURS. PERFORMANCE WAS MEASURED IN TERMS OF MAN HOURS TO DEBUG AND CENTRAL PROCESSOR TIME USED IN DEBUGGING. PROGRAMMERS WHO DEBUGGED THEIR ALGEBRAIC INTERPRETATION PROGRAMS ON-LINE USED SLIGHTLY FEWER MAN HOURS AND ABOUT THREE TIMES AS MUCH CENTRAL PROCESSOR TIME AS DID PROGRAMMERS WHO DEBUGGED THESE PROGRAMS OFF-LINE. PROGRAMMERS WHO DEBUGGED THEIR MAZE PROGRAMS ON-LINE USED ABOUT ONE-THIRD AS MANY MAN HOURS AND SLIGHTLY MORE CENTRAL PROCESSOR TIME THAN THOSE WHO DEBUGGED THEIR MAZE PROGRAMS OFF-LINE. RESULTS ARE DISCUSSED AND THE FOLLOWING POINTS ARE COVERED IN AN EFFORT TO RECONCILE THE DISPARATE RESULTS FROM THE TWO KINDS OF PROGRAMS: (1) THE ADEQUACY AND REALISM OF OFF-LINE SIMULATION, (2) INEQUALITIES BETWEEN THE GROUPS ASSIGNED TO EXPERIMENTAL CONDITIONS, (3) QUALITATIVE DIFFERENCES BETWEEN THE FOW KINDS OF EXPERIMENTAL CONDITIONS, (4) POSSIBLE ADOPTION OF INEFFICIENT WORK HABITS ON THE PART OF PROGRAMMERS WORKING ON-LINE. (A) 16P, 8R.

COMMENTS:

THIS EXPERIMENT IS REPORTED IN MORE DETAIL AND IN A MORE INFORMATIVE MANNER BY E.E. GRANT AND H. SACKMAN (1967).

194 TIME-SHARING VS. BATCH PROCESSING
GRANT, E.E., & SACKMAN, H. AN EXPLORATORY INVESTIGATION OF PROGRAMMER
PERFORMANCE UNDER ON-LINE AND OFF-LINE CONDITIONS. IEEE TRANSACTIONS ON HUMAN
FACTORS IN ELECTRONICS, 1967, HFE-8, 33-48.
DESCRIPTION:

THIS IS THE FIRST KNOWN STUDY COMPARING THE PERFORMANCE OF PROGRAMMERS UNDER CONTROLLED CONDITIONS FOR A STANDARD TASK. AN EXPERIMENT WAS CONDUCTED TO COMPARE THE PERFORMANCE OF PROGRAMMERS WORKING UNDER CONDITIONS OF ON-LINE AND OFF-LINE ACCESS TO THE COMPUTER. TWO GROUPS OF SIX PROGRAMMERS EACH, COMPRISING A SAMPLE OF 12 SUBJECTS, CODED AND DEBUGGED TWO TYPES OF PROBLEMS UNDER ON-LINE AND OFF-LINE CONDITIONS IN ACCORDANCE WITH A LATIN-SQUARE EXPERIMENTAL DESIGN. THE ON-LINE CONDITION WAS THE NORMAL MODE OF OPERATION FOR THE SYSTEM DEVELOPMENT CORPORATION TIME-SHARING SYSTEM; THE OFF-LINE CONDITION WAS SIMULATED USING A TWO-HOUR TURNARDUND TIME.

STATISTICALLY SIGNIFICANT RESULTS INDICATED FASTER DEBUGGING UNDER ON-LINE CONDITIONS. PERHAPS THE MOST IMPORTANT PRACTICAL FINDING OF THIS STUDY, OVERSHADOWING ON-LINE/OFF-LINE DIFFERENCES, CONCERNED THE LARGE AND STRIKING INDIVIDUAL DIFFERENCES IN PROGRAMMER PERFORMANCE. ATTEMPTS ARE MADE TO RELATE OBSERVED INDIVIDUAL DIFFERENCES TO OBJECTIVE MEASURES OF PROGRAMMER EXPERIENCE AND PROFICIENCY THROUGH FACTORIAL TECHNIQUES. IN LINE WITH THE EXPLORATORY OBJECTIVES OF THIS STUDY, METHODOLOGICAL PROBLEMS ENCOUNTERED IN DESIGNING AND CONDUCTING THIS TYPE OF EXPERIMENT ARE DESCRIBED, LIMITATIONS OF THE FINDINGS ARE POINTED OUT, HYPOTHESES ARE PRESENTED TO ACCOUNT FOR THE RESULTS, AND SUGGESTIONS ARE MADE FOR FURTHER RESEARCH. (A)

16P, 13R. COMMENTS:

THIS IS AN EARLY, AND OFTEN CITED, ATTEMPT TO COMPARE THE EFFECTS OF BATCH AND TIME-SHARED PROGRAM DEVELOPMENT ON PROGRAMMER PERFORMANCE. IN THIS STUDY, ALL PROGRAMS WERE WRITTEN AND CODED OFF-LINE AND ONLY DEBUGGING PERFORMANCE WAS OBSERVED UNDER BOTH ON-LINE (TIME-SHARED) AND OFF-LINE (BATCH) CONDITIONS. IN ADDITION, THE OFF-LINE CONDITION WAS SIMULATED ON AN ON-LINE SYSTEM. WHILE THIS HAS THE ADVANTAGE OF HOLDING SEVERAL POTENTIALLY IMPORTANT VARIABLES, SUCH AS METHOD OF PROGRAM SUBMISSION, CONSTANT, IT HAS THE DISADVANTAGE THAT A NUMBER OF ARBITRARY ASSUMPTIONS ARE REQUIRED TO SIMULATE OFF-LINE CONDITIONS. FOR EXAMPLE, TURNAROUND TIME FOR THE OFF-LINE CONDITION WAS SET AT TWO HOURS. WHILE THIS MAY BE AN ACCURATE ESTIMATE OF THE AVERAGE TURNAROUND FOR OFF-LINE SYSTEMS, THE USE OF A CONSTANT TIME DOES NOT ALLOW FOR VARIABILITY. TH MAY BE A SIGNIFICANT OMISSION SINCE J.R. CARBONELL, J.I. ELKIND, AND R.S. NICKERSON (1968) DEMONSTRATED THAT USER PERFORMANCE IS AFFECTED BY RESPONSE TIME VARIABILITY. IN ADDITION, OTHER ASSUMPTIONS, SUCH AS LIMITING THE NUMBER OF CORRECTIONS PER SUBMISSION IN THE OFF-LINE CONDITION, MAY NOT BE TRULY REPRESENTATIVE OF OFF-LINE SYSTEMS. THE MOST IMPORTANT CONTRIBUTION OF THIS PAPER IS THAT IT IS THE FIRST ATTEMPT TO MEASURE INDIVIOUAL DIFFERENCES UNDER CONTROLLED CONDITIONS. INDIVIDUAL DIFFERENCES IN PROGRAMMER PERFORMANCE WERE QUITE LARGE AND THIS ISSUE IS DISCUSSED FAIRLY EXTENSIVELY. SEE ALSO B.W. LAMPSON (1967) FOR A CRITICAL COMMENTARY ON THIS PAPER.

195 DESIGN OF MESSAGES FOR INTERACTIVE DISPLAY
GREEN, E.E. MESSAGE DESIGN: GRAPHIC DISPLAY STRATEGIES FOR INSTRUCTION. IN
ACM '76: PROCEEDINGS OF THE ANNUAL CONFERENCE. NEW YORK: ASSOCIATION FOR
COMPUTING MACHINERY, 1976, 144-148.
DESCRIPTION:

MESSAGE DESIGN IS CONCERNED WITH THE CLARITY, ACCURACY, AND CONCISENESS OF MESSAGES AND THEIR DESIGN AS A VISUAL PERCEPTION. BECAUSE SO MANY VARIABLES EXIST IN VISUALIZED INSTRUCTION STUDIES, A SINGLE THEORY TO PREDICT LEARNING EFFICIENCY AND EFFECTIVENESS IS VIRTUALLY IMPOSSIBLE. THE EFFECT OF INSTRUCTION SEEMS TO BE A MATTER OF TYPES OF VISUALS USED, METHODS OF CUEING, RELEVANT STUDENT CHARACTERISTICS, METHODS OF PRESENTATION, TYPE OF EDUCATIONAL OBJECTIVES ACHIEVED, AND A WHOLE HOST OF SOCIOLOGICAL, PSYCHOLOGICAL AND ENVIRONMENTAL FACTORS. RESEARCH IN THIS AS A BEHAVIORAL SCIENCE IS THUS MORE USEFUL WHEN IT IS LOCALIZED TO CATER TO SPECIFIC SITUATIONAL REQUIREMENTS. A NEED ALSO EXISTS TO MATCH THESE WITH THE MAIN CRITERIA OF GOOD MESSAGE DESIGN WHICH IS A SUBSET OF INSTRUCTIONAL SYSTEMS DESIGN. THIS ARTICLE EXPLAINS WHAT MESSAGE DESIGNERS CAN DO TO (1) ATTRACT LEARNER ATTENTION TO DISPLAYS, (2) HOLD THEIR ATTENTION, AND (3) PROVIDE ADEQUATE CUEING DEVICES FOR EFFICIENT AND EFFECTIVE LEARNING TO TAKE PLACE.

SP, 9R.

THIS IS A CLEARLY WRITTEN AND INFORMATIVE PAPER THAT IDENTIFIES SEVERAL FACTORS THAT ARE RELEVANT TO EFFECTIVE MESSAGE DESIGN. THE AUTHOR ALSO INDICATES THAT THESE FACTORS CAN BE RELATED TO THEORIES OF HUMAN BEHAVIOR AND THAT THESE THEORIES MAY HAVE DIRECT AND USEFUL APPLICATIONS TO MESSAGE DESIGN. ALTHOUGH THIS PAPER DOES NOT CONTAIN EXPLICIT GUIDELINES, IT DOES PRESENT IDEAS THAT WOULD BE OF INTEREST TO ANYONE CONCERNED WITH MESSAGE DESIGN.

196 MAN-COMPUTER DIALOGUE IN BIBLIOGRAPHIC SEARCH SYSTEM GREEN, J.S., V. GRINS, AN ON-LINE STRUCTURE FOR THE NEGOTIATION OF INQUIRIES (STUDIES IN THE MAN-SYSTEM INTERFACE IN LIBRARIES REPORT NO. 4). BETHLEHEM, PENNSYLVANIA: LEHIGH UNIVERSITY, SEPTEMBER 1967. (NTIS NO. AD 660089) DESCRIPTION:

IN GENERAL, PROBLEMS ARE SOLVABLE ALONG A CONTINUUM OF ABSTRACTION. THERE IS, AT ANY GIVEN POINT IN THE DEVELOPMENT OF THE SOLUTION, A MOST EFFICIENT OR OPTIMUM STRATEGY.

IN INFORMATION RETRIEVAL SYSTEMS THE ULTIMATE SOLUTION IS OBTAINED AT A MORE SPECIFIC RATHER THAN AT A MORE ABSTRACT LEVEL. THE QUESTION NEGOTIATION PROCESS IS VIEWED AS AN EFFICIENT PRELIMINARY STRATEGY WHICH ENABLES AN INFORMATION SEEKER TO OBTAIN HIS INFORMATION GOAL WITH THE LEAST AMOUNT OF OVERALL EFFORT.

IN ORDER FOR A PROBLEM SOLUTION PROCEDURE TO REMAIN EFFICIENT A MEANS FOR PREDICTING WHEN TO CHANGE STRATEGIES MUST BE PROVIDED. IN THE PARTICULAR EXAMPLE OF QUESTION NEGOTIATION, THIS PREDICTION IS BASED ON THE RATE AT WHICH THE DEFINITION OF THE USER'S NEED DEVELOPS.

AN ON-LINE COMPUTER PROGRAM CALLED GRINS IS DESCRIBED WHICH IMPLEMENTS THE INFORMATION SPECIALIST'S ROLE IN THE NEGOTIATING OF A USER'S NEED. THIS PROGRAM COMMUNICATES WITH THE USER IN HIS NATURAL CONVERSATIONAL IDIOM. WHEN THE NEGOTIATION IS JUDGED BY GRINS TO BE AS WELL DEVELOPED AS IT IS LIKELY TO GET, A SEARCH IS MADE OF THE AVAILABLE DOCUMENTS. THIS SEARCH PRODUCES AN ORDERED LIST OF THE SIXTY-THREE BEST DOCUMENTS WHICH COME CLOSEST TO THE USER'S EXPRESSED NEED.

THE STRUCTURE OF THE PROGRAM IS MODULAR SO THAT IMPROVEMENTS MAY BE EASILY MADE. SOME SUCH IMPROVEMENTS ARE SUGGESTED. (A) 62P. 17R.

#### COMMENTS:

THIS PAPER FOCUSES ON HELPING THE USER OF AN INTERACTIVE DOCUMENT RETRIEVAL SYSTEM TO FORMULATE EFFECTIVE DEFINITIONS OF HIS INFORMATION NEEDS. IN BATCH RETRIEVAL SYSTEMS, IT IS COMMON TO HAVE AN "INFORMATION SPECIALIST" WHO IS FAMILIAR WITH THE SYSTEM AND ITS CAPABILITES AND WHOSE JOB IS TO QUESTION THE USER ABOUT HIS NEEDS AND TO FORMULATE THE APPROPRIATE QUERY. IN THE RESEARCH DESCRIBED IN THIS PAPER, THE FUNCTIONS OF THE INFORMATION SPECIALIST ARE IMPLEMENTED IN AN INTERACTIVE COMPUTER PROGRAM. THIS PROGRAM ACCEPTS NATURAL LANGUAGE INPUT, SEARCHES FOR KEY WORDS, AND TRIES TO ELICIT THE APPROPRIATE INDEX TERMS FROM THE USER. ALTHOUGH THIS PAPER DEMONSTRATES THE FEASIBILITY OF IMPLEMENTING SUCH A DIALOGUE, AND PRESENTS TWO EXAMPLES, IT PRESENTS LITTLE EVIDENCE THAT SUCH DIALOGUES ARE MANAGEABLE BY THE ULTIMATE USERS OF ON-LINE BIBLIOGRAPHIC SEARCH SYSTEMS. AN ALTERNATIVE APPROACH, IN WHICH THE USER IS TRAINED TO SERVE AS HIS OWN INFORMATION SPECIALIST IS PRESENTED IN D.E. CARUSO (1970).

# 197 ARCHITECTURAL APPLICATIONS

GREENWALD-KATZ, G. COMPUTERS IN ARCHITECTURE. AFIPS CONFERENCE PROCEEDINGS, 1976, 45, 315-320.

## DESCRIPTION:

THE UNION OF COMPUTERS AND ARCHITECTURE HAS NOT COME ABOUT IN SPITE OF GLOWING PREDICTIONS OVER THE LAST TEN YEARS. THIS PAPER DESCRIBES SEVERAL OF THE REASONS WHY THIS MAY BE SO: THE COMPLEXITY OF THE PROFESSION, THE INATTENTION AS TO HOW THE ARCHITECTS ACTUALLY DESIGN AND THE LACK OF TOP MANAGEMENT DEDICATION. THE CURRENT STATE OF THE ARCHITECTURAL PROFESSION IS EXPLORED AND WHY THE ARCHITECT'S ENTRY INTO NEW AREAS SHOULD SPARK A DEMAND FOR COMPUTER TECHNOLOGY IS DISCUSSED. (A)

#### COMMENTS:

THIS PAPER PRESENTS THE AUTHOR'S OPINIONS CONCERNING SOME OF THE CAUSES OF THE POORER-THAN-EXPECTED ACCEPTANCE AND USE OF COMPUTERS IN ARCHITECTURAL APPLICATIONS. HER COMMENTS ON THE RELATIONSHIP BETWEEN THE USER'S VIEW OF HIS TASK AND HIS ATTITUDE TOWARD COMPUTER AIDS MAY PROVE THOUGHT-PROVOKING.

198 DISPLAYS

GRETHER, W.F., & BAKER, C.A. VISUAL PRESENTATION OF INFORMATION. IN H.P. VAN COTT & R.G. KINKADE (EDS.), HUMAN ENGINEERING GUIDE TO EQUIPMENT DESIGN (REV. ED.). WASHINGTON, D.C.: U.S. GOVERNMENT PRINTING OFFICE, 1972, 41-121, DESCRIPTION:

HOW VISUAL DISPLAYS ARE ADAPTED TO HUMAN USE IS CONSIDERED IN THIS CHAPTER. THE PURPOSES OF THE DISPLAYS AND THE CONDITIONS AND METHODS OF THEIR PRESENTATION ARE DISCUSSED FIRST, FOLLOWED BY A SECTION DEFINING MEASUREMENT TERMS, INCLUDING VISUAL ACUITY IN OBJECT DETECTION AND IDENTIFICATION. A DELINEATION OF PROPER WORKPLACE ILLUMINATION IS PRESENTED NEXT, THEN SECTIONS COVERING SUCH SUBJECTS AS VISUAL CODING TECHNIQUES THROUGH USE OF COLOR AND SHAPE, DESIGN RECOMMENDATIONS FOR WARNING AND SIGNAL DEVICES, AND FOR MECHANICAL INDICATORS. ELECTRONIC DISPLAYS, PRINTED INFORMATION, AND PROJECTION OF IMAGES COMPLETE THE RANGE OF MATERIAL DISCUSSED. (A) 82P, 123R.

COMMENTS:

THIS IS A WELL-WRITTEN AND INTEGRATIVE REVIEW OF THE STATE OF THE ART IN INFORMATION PRESENTATION. AFTER DEFINING RELEVANT TERMS AND CONCEPTS, CONCLUSIONS DERIVED FROM NUMEROUS EMPIRICAL STUDIES ARE PRESENTED. THE FORM AND CONTENT OF THIS PAPER MAKE IT USEFUL AS EITHER A TUTORIAL OR INTRODUCTION TO HUMAN FACTORS ASPECTS OF VISUAL INFORMATION PRESENTATION OR AS A QUICK REFERENCE FOR THOSE MORE KNOWLEDGABLE IN THIS AREA. THERE ARE NO COMMENTS ON THE INDIVIDUAL EXPERIMENTS REVIEWED; RATHER, THE RESULTS ARE PRESENTED AS FIRM AND FAST GUIDELINES. ALTHOUGH THIS MAY BE ADVANTAGEOUS, OR EVEN NECESSARY, IN SUCH A GUIDEBOOK, IT LEAVES TO THE MEADER THE TASK OF DETERMINING THE APPROPRIATEMESS AND VALIDITY OF THESE EXPERIMENTS AND THE EFFECTS OF VARIANCE IN PERFORMANCE AROUND THE MEAN VALUES GIVEN.

199 SEQUENCE-OF-EVENTS DISPLAYS

GRIFFIN, J.D.A. EXPERIENCES IN DISPLAYING SEQUENCE-OF-EVENTS INFORMATION. IN PROCEEDINGS, 3RD MAN-COMPUTER COMMUNICATIONS SEMINAR. OTTAWA, ONTARIO, CANADA: NATIONAL RESEARCH COUNCIL OF CANADA, 1973, 28.1-28.6. DESCRIPTION:

THE INSTALLATION OF A SEQUENCE-DF-EVENTS MONITOR IN A LARGE GENERATING PLANT CREATES CHALLENGING PROBLEMS IN THE MAN-MACHINE INTERFACE. AS MANY AS SEVERAL HUNDRED DISCRETE EVENTS MAY TAKE PLACE WITHIN THE SPACE OF A FEW SECONDS. SINCE SOME OR ALL OF THESE EVENTS MAY BE OF IMMEDIATE CONCERN TO THE PLANT OPERATORS IT IS IMPORTANT TO DISPLAY THE INFORMATION EFFECTIVELY. THIS PAPER OUTLINES THE PROBLEMS FACED IN ONE RECENT INSTALLATION AND THE APPROACHES USED TO SOLVE THEM. (A) 6P, OR.

COMMENTS:

IN A LARGE SCALE EQUIPMENT MONITORING SITUATION, A LARGE NUMBER OF OPERATIONS CAN TAKE PLACE IN A VERY SHORT TIME. THIS PAPER ADDRESSES THE QUESTION OF WHETHER THE COMPUTER OR THE OPERATOR SHOULD CONTROL THE DISPLAY OF THESE OPERATIONS. IT IS SUGGESTED THAT THE OPERATOR SHOULD BE PRESENTED WITH A DISPLAY OF ONLY THOSE OPERATIONS EXPLICITLY SELECTED. WHILE THIS MAY BE PREFERABLE TO THE AUTOMATIC DISPLAY OF ALL OPERATIONS, SOME COMPROMISE BETWEEN THESE TWO EXTREME POSITIONS APPEARS MORE REASONABLE. THAT IS, THE OPERATOR COULD RETAIN CONTROL OF THE DISPLAY, BUT THE COMPUTER COULD INTERVENE TO DISPLAY "CRITICAL" INFORMATION, ETC. THE LARGE AMOUNT OF INFORMATION THAT MUST BE PROCESSED IN A SMORT TIME INDICATES THE NEED FOR A MORE EFFECTIVE FORM OF MAN-MACHINE INTERACTION THAT TAKES BETTER ADVANTAGE OF THE DIFFERENTIAL CAPABILITIES OF BOTH MAN AND MACHINE.

200 EMBEDDED TRAINING

GRIGNETTI, M.C., GOULD, L., HAUSMANN, C.L., BELL, A.G., HARRIS, G., & PASSAFIUME, J. MIXED-INITIATIVE TUTORIAL SYSTEM TO AID USERS OF THE ON-LINE SYSTEM (NLS) (TECHNICAL REPORT ESD-TR-75-58). HANSCOM AIR FORCE BASE, BEDFORD, MASSACHUSETTS: ELECTRONIC SYSTEMS DIVISION, NOVEMBER 1974. DESCRIPTION:

NLS-SCHOLAR IS A PROTOTYPE SYSTEM THAT USES ARTIFICIAL INTELLIGENCE TECHNIQUES TO TEACH COMPUTER-NAIVE PEOPLE HOW TO USE A POWERFUL AND COMPLEX EDITOR. IT REPRESENTS A NEW KIND OF COMPUTER ASSISTED INSTRUCTION (CAI) SYSTEM THAT INTEGRATES SYSTEMATIC TEACHING WITH ACTUAL PRACTICE, I.E., ONE WHICH CAN KEEP THE USER UNDER TUTORIAL SUPERVISION WHILE ALLOWING HIM TO TRY OUT WHAT HE LEARNS ON THE SYSTEM HE IS LEARNING ABOUT.

NLS-SCHOLAR CAN ALSO BE USED AS AN ON-LINE HELP SYSTEM OUTSIDE THE TUTORIAL ENVIRONMENT, IN THE COURSE OF A USER'S ACTUAL WORK. THIS CAPABILITY OF COMBINING ON-LINE ASSISTANCE WITH TRAINING IS AN EXTENSION OF THE TRADITIONAL NOTION OF CAL.

THE TECHNIQUES USED IN NLS-SCHOLAR ARE GENERAL AND CAN BE APPLIED TO THE TEACHING OF A WIDE VARIETY OF COMPUTER RELATED ACTIVITIES. (A) 131P, 11R.

### COMMENTS:

SCHOLAR IS A MIXED-INITIATIVE, GENERATIVE COMPUTER-ASSISTED INSTRUCTION (CAI) SYSTEM. FOR THE LIMITED PROBLEM DOMAINS IN WHICH IT HAS BEEN IMPLEMENTED, SCHOLAR IS VERY EFFECTIVE BOTH AS A CAI SYSTEM AND AS A NATURAL-LANGUAGE DIALOGUE SYSTEM. NLS PROVIDES POWERFUL AND USEFUL TECHNIQUES FOR PREPARING AND DISTRIBUTING DOCUMENTS. A SERIOUS DISADVANTAGE OF NLS, HOWEVER, IS THAT ITS COMPLEXITY QUICKLY DISCOURAGES POTENTIAL USERS. THIS PAPER FOCUSES ON ADAPTING SCHOLAR TO BE USED AS AN AID FOR HELPING INDIVIDUALS INTERACT WITH NLS. THE CAPABILITY OF NLS-SCHOLAR TO FUNCTION BOTH AS AN ON-LINE ASSISTANCE DEVICE AND AS A TRAINING DEVICE IS AN IMPORTANT AND VALUABLE ADDITION TO THE AREA OF COMPUTER-ASSISTED INSTRUCTION. THE SYSTEM PROPOSED IN THIS PAPER, THOUGH NOT FULLY IMPLEMENTED, OFFERS GREAT POTENTIAL FOR AIDING HUMAN INTERACTION WITH COMPLEX SYSTEMS.

201 MAN-COMPUTER DIALOGUE

GRIGNETTI, M.C., & MILLER, D.C. NODIFYING COMPUTER RESPONSE CHARACTERISTICS TO INFLUENCE COMMAND CHOICE. IN MAN-COMPUTER INTERACTION (PROCEEDINGS, CONFERENCE ON MAN-COMPUTER INTERACTION, 2-4 SEPTEMBER 1970) (CONFERENCE PUBLICATION NO. 68). LONDON, ENGLAND: INSTITUTION OF ELECTRICAL ENGINEERS, 1970, 201-205. DESCRIPTION:

THE PURPOSE OF THIS RESEARCH IS TO EXAMINE METHODS FOR ALTERING USERS' BEHAVIOR SO THAT OVERALL PERFORMANCE OF A TIME-SHARING SYSTEM CAN BE IMPROVED. A TIME-SHARING SYSTEM WAS MODIFIED TO PROVIDE INCENTIVES TO LEAD USERS TO ADOPT BEHAVIOR THAT, ALTHOUGH INITIALLY PERCEIVED AS DETRIMENTAL By the user, will result in greater user satisfaction and more nearly OPTIMAL SYSTEM PERFORMANCE. AN EXPERIMENT INDICATED THAT SUCH INCENTIVES COULD AFFECT USER BEHAVIOR.

5P, OR. COMMENTS:

THIS PAPER BEGINS WITH THE CORRECT ASSUMPTION THAT USER BEHAVIOR AND SYSTEM PERFORMANCE ARE INTERRELATED. SYSTEM PERFORMANCE IS CLEARLY AFFECTED BY THE DEMANDS MADE BY THE USER, AND THE USER, WHEN ABLE TO SELECT ARONG ALTERNATIVE COMMANDS, WILL SELECT A COMMAND ON THE BASIS OF PERCEIVED SYSTEM PERFORMANCE. THE EXPERIMENT REPORTED IN THIS PAPER IS AN ATTEMPT TO DEMONSTRATE THAT THE UTILITY FUNCTION THAT A PERSON EMPLOYS TO EVALUATE ALTERNATIVE ACTIONS CAN BE EXPERIMENTALLY MANIPULATED. ALTHOUGH THIS IS CLEARLY NOT A NOVEL IDEA, THE APPLICATION TO TIME-SHARING SYSTEMS COULD BE VERY PRODUCTIVE. THIS PAPER SUGGESTS THAT THIS IS THE CASE. THIS EXPERIMENT IS NOT DESCRIBED IN SUFFICIENT DETAIL, HOWEVER, TO ALLOW THE READER TO EVALUATE THE VALIDITY OF THIS CLAIM. NEVERTHELESS, THIS PAPER DOES EXPRESS A CONCEPT THAT SHOULD BE VERY INTERESTING TO ANYONE CONCERNED WITH METHODS FOR PROMOTING MORE OPTIMAL USE OF TIME-SHARED SYSTEMS.

202 MODIFICATION OF USER BEHAVIOR IN TIME-SHARING SYSTEMS GRIGHETTI, M.C., & MILLER, D.C. INFORMATION PROCESSING MODELS AND COMPUTER AIDS FOR HUMAN PERFORMANCE, TASK 2: MODELS OF HUMAN-COMPUTER INTERACTION (REPORT NO. AFOSR-TR-71-2790). CAMBRIDGE, MASSACHUSETTS: BOLT BERANEK AND NEWMAN, INC., JUNE 1971. (NTIS NO. AD 732232) DESCRIPTION:

WE HAVE CONDUCTED EXPERIMENTS TO EXPLORE METHODS OF MOTIVATING TIME-SHARING USERS TO ADOPT BEHAVIOR PATTERNS THAT IMPROVE OVERALL SYSTEM PERFORMANCE. IT WAS FOUND THAT WHILE IT IS INDEED POSSIBLE FOR A TIME-SHARING SYSTEM TO PROVIDE INCENTIVES TO USERS THAT WILL AFFECT THEIR CHOICES BETWEEN ALTERNATIVE METHODS OF ACCOMPLISHING A GIVEN TASK, THE EXTENT OF THIS EFFECT IS NOT ENTIRELY PREDICTABLE.

WE HAVE ALSO DESIGNED AND IMPLEMENTED A MEASURING SYSTEM FOR THE SDS-940 TIME-SHARING COMUTER SYSTEM. THIS MEASURING SYSTEM YIELDED DATA THAT WERE USEFUL IN INCREASING OUR UNDERSTANDING OF THE DYNAMIC BEHAVIOR OF PROGRAMS IN A TIME-SHARING SYSTEM AND, MORE SPECIFICALLY, IN IMPROVING OVERALL SYSTEM PERFORMANCE. (A) 21P, DR.

COMMENTS:

THE PRINCIPAL SECTION OF THIS REPORT IS A PAPER PREVIOUSLY PRESENTED BY M.C. GRIGNETTI AND D.C. MILLER (1970). THE PRESENT PAPER ALSO INCLUDES A SHORT DISCUSSION OF THE RATIONALE UNDERLYING RESEARCH DIRECTED AT CONSTRUCTING MODELS OF MAN-COMPUTER INTERACTION IN TIME-SHARING ENVIRONMENTS.

203 MODELING OF MAN-COMPUTER INTERACTION
GRIGNETTI, M.C., MILLER, D.C., NICKERSON, R.S., & PEW, R.W. INFORMATION
PROCESSING MODELS AND COMPUTER AIDS FOR HUMAN PERFORMANCE: TASK 2: HUMANCOMPUTER INTERACTION MODELS (REPORT NO. AFOSR-TR-71-2845). CAMBRIDGE,
MASSACHUSETTS: BOLT BERANEK AND NEWMAN, INC., JUNE 1971. (NTIS NO. AD 732913)

DESCRIPTION:
WE HAVE IMPLEMENTED A MEASURING SYSTEM TO OBTAIN THE STATISTICAL PARAMETERS NECESSARY TO SPECIFY A QUEUEING THEORY MODEL OF THE DYNAMIC BEHAVIOR OF A STATE-OF-THE-ART TIME-SHARED COMPUTER SYSTEM, AND PRESENT RESULTS OF THE STATISTICS OF USAGE OF ONE SUCH COMPUTER SYSTEM.

STATISTICS OF USAGE OF ONE SUCH COMPUTER SYSTEM.

WE PRESENT A METHODOLOGY FOR THE PERFORMANCE OF EXPERIMENTS INVOLVING HUMAN USERS AND FOR THE INTERPRETATION OF THEIR RESULTS. WE EXPECT THAT THESE RESULTS WILL YIELD PREDICTIVE MODELS FOR THE OVERALL EFFICIENCY OF THE "USERS-COMPUTER SYSTEM" UNDER VARIOUS CIRCUMSTANCES.

A PAPER HAS BEEN PREPARED FOR PUBLICATION DESCRIBING THE FEATURES THAT A SYSTEM SHOULD INCORPORATE IN ORDER TO BE CONSIDERED EFFECTIVE AND WELL HUMAN ENGINEERED. (A) 95F, 8R.

COMMENTS:

THE MODEL PRESENTED IN THIS PAPER ASSUMES THAT INTERACTIONS CAN BE CHARACTERIZED IN TERMS OF THE COMPUTER RESOURCES DEMANDED BY THE USERS' COMMANDS. THE RESOURCES INCLUDED ARE CPU TIME, CORE REQUIRED, AND AMOUNT OF I/O. SUGGESTIONS ARE MADE FOR MODELING THE USER IN TERMS OF THESE RESOURCE DEMANDS AND USING SIMULATED USERS TO EXPERIMENT WITH VARIOUS SYSTEM CONFIGURATIONS AND PROPERTIES. IN TERMS OF THESE TYPES OF RESOURCES, THE MODEL APPEARS TO BE BOTH REASONABLE AND USEFUL. THE PRINCIPAL SHORTCOMING OF THIS MODEL IS THAT IT DOES NOT CONSIDER RESPONSE TIME, DIALOGUE TYPE, OR SIMILAR FACTORS THAT ARE KNOWN TO EFFECT HUMAN PERFORMANCE IN INTERACTIVE SYSTEMS. THE ADDITION OF SUCH FACTORS WOULD GREATLY IMPROVE THE USEFULNESS OF THIS MODEL.

STATISTICAL PROBLEMS WITH USER PREFERENCE RATINGS
GROCHOW, J.M. ON USER SUPPLIED EVALUATIONS OF TIME-SHARED COMPUTER SYSTEMS.
IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS, 1973, SMC-3, 204-206. DESCRIPTION:

COMMENTS ARE MADE REGARDING THE COLLECTION OF USER PREFERENCE DATA FOR VARYING CHARACTERISTICS OF TIME-SHARING SYSTEMS. THESE "UTILITY FUNCTIONS," WHEN DETERMINED FOR A NUMBER OF VARIABLES, CAN BE USED AS AN AID TO MANAGERS AND DESIGNERS OF TIME-SHARING SERVICE FACILITIES.

THERE ARE, HOWEVER, SEVERAL PRACTICAL PROBLEMS IN ASSESSING UTILITY FUNCTIONS OF MORE THAN ONE VARIABLE. THESE STEM MAINLY FROM THE FACT THAT UTILITY FUNCTIONS OF SEVERAL VARIABLES ARE GENERALLY NOT SIMPLE ADDITIVE FUNCTIONS OF UTILITIES FOR SINGLE VARIABLES. IN MOST CASES, THEY ARE COMPLEX FUNCTIONS CONSISTING OF MANY MORE COMPONENT UTILITY FUNCTIONS THAN THE NUMBER OF VARIABLES. THIS DIFFICULTY STEMS FROM THE FACT THAT PREFERENCES FOR A SET OF VARIABLES DESCRIBING A SERVICE FACILITY (SUCH AS A TIME-SHARING SYSTEM) ARE GENERALLY NOT INDEPENDENT OF CURRENT VALUES OF OTHER VARIABLES. THIS IS KNOWN AS "UTILITY DEPENDENCE." IF, HOWEVER, A SUFFICIENT NUMBER OF "UTILITY INDEPENDENCE" RELATIONSHIPS CAN BE FOUND (BY INTERVIEW PROCEDURES), THEN IT IS POSSIBLE TO ASSESS MULTIDIMENSIONAL UTILITY FUNCTIONS WITH A MORE PRACTICAL EFFORT. PROCEDURES FOR THIS ASSESSMENT AND USES OF UTILITY FUNCTIONS IN MANAGING A TIME-SHARING SYSTEM ARE DESCRIBED HERE. (A) 78. 3P,

COMMENTS:

S.T. JUTILA AND G. BARAN (1971) CONSIDERED SEVERAL FACTORS THAT ARE RELEVANT IN USER-ORIENTED EVALUATIONS OF TIME-SHARED SYSTEMS AND, USING UTILITY FUNCTIONS, RELATED THESE FACTORS WITH USER SATISFACTION. IN THE PRESENT PAPER, THE AUTHOR BRIEFLY REVIEWS THE USE OF UTILITY FUNCTIONS AND CRITICIZES JUTILA AND BARAM FOR MAKING UNWARRANTED (BUT SIMPLIFYING) ASSUMPTIONS. ALTHOUGH SUCH PROBLEMS ARE POINTED OUT, NO SOLUTIONS ARE OFFERED. THIS PAPER BOULD PROBABLY ONLY BE READ IN CONJUNCTION WITH THE EARLIER PAPER BY JUTILA AND BARAM.

VISUAL DEPTH FACTORS IN GRAPHICAL DISPLAYS GUTTMANN, H.E., & ANDERSON, D.A. STUDIES COMPARING EFFECTIVENESS OF THREE-DIMENSIONAL VERSUS TWO-DIMENSIONAL PRESENTATIONS (REPORT NO. 1525-TR1). MINNEAPOLIS, MINNESOTA: MINNEAPOLIS-HONEYWELL REGULATOR COMPANY, MILITARY PRODUCTS GROUP, NOVEMBER 1962. DESCRIPTION:

THIS STUDY COMPARED THE EFFICACY OF TWO TYPES OF DISPLAYS: A REAL THREE-DIMENSIONAL DISPLAY VERSUS AN ORTHOGONAL DUAL PROJECTION TWO-DIMENSIONAL DISPLAY. SUBJECTS WERE REQUIRED TO MAKE JUDGMENTS OF ABSOLUTE POSITION OF TARGETS, RELATIVE POSITION OF TARGETS, ABSOLUTE VELOCITY, AND RELATIVE VELOCITY. IN JUDGMENTS OF ABSOLUTE VELOCITY, PERFORMANCE WAS SLIGHTLY SUPERIOR ON THE THREE-DIMENSIONAL DISPLAY. IN THE OTHER AREAS INVESTIGATED, PERFORMANCE WAS SUPERIOR ON THE TWO-DIMENSIONAL DISPLAY. (A)

ORTHOGONAL DUAL PROJECTION INVOLVES TWO TWO-DIMENSIONAL VIEWS AT RIGHT

ANGLES (E.G., AN XY PROJECTION AND A YZ PROJECTION).

65P, BR. COMMENTS:

IT SHOULD BE NOTED THAT THE THREE-DIMENSIONAL DISPLAY WAS AN ACTUAL THREE-DIMENSIONAL DEVICE AND THAT THE TWO-DIMENSIONAL DISPLAY WAS SIMULATED WITH THIS DEVICE. PERFORMANCE WITH THE THREE-DIMENSIONAL DISPLAY WAS WITH THIS DEVICE. PERFORMANCE WITH THE THREE-DIMENSIONAL DISPLAY WAS EXCEPTIONALLY POOR ON THE LONGITUDINAL DIMENSION (TOWARD OR AWAY FROM THE OBSERVER). LOCATING AN OBJECT ALONG THIS DIMENSION IS HAMPERED DUE TO PARALLAX, AND, IN THIS EXPERIMENT, THE LACK OF RELEVANT CUES NORMALLY USED IN DEPTH PERCEPTION. THE PSYCHOLOGY AND PSYCHOPHYSIOLOGY OF LOCATING TARGETS IN TWO DIMENSIONS IS MUCH SIMPLER, ESPECIALLY WHLM NORMAL DEPTH CUES ARE ABSENT, AND PERFORMANCE IS MUCH MORE ACCURATE. THREE-DIMENSIONAL DISPLAYS CAN BE VERY USEFUL IN CERTAIN SITUATIONS, SUCH AS IN INTERACTIVE GRAPHICS. OPTHOGODAL DIALL PROJECTION DISPLAYS. HOWEVER, ARE SUPERIOR FOR GRAPHICS. ORTHOGONAL DUAL PROJECTION DISPLAYS, HOWEVER, ARE SUPERIOR FOR LOCATING AND CLASSIFYING THE MOVEMENT OF TARGETS.

206 DESCRIPTION OF SRI AUGMENTED HUMAN INTELLECT RESEARCH CENTER
HAAVIND, R. MAN-COMPUTER 'PARTNERSHIPS' EXPLORED. ELECTRONIC DESIGN, FEBRUARY
1969, 17(3), 25-32. (SRI-ARC CATALOG ITEM 13961)
DESCRIPTION:

THE GOAL OF THE AUGMENTED HUMAN INTELLECT RESEARCH CENTER AT STANFORD RESEARCH INSTITUTE IS TO DEVELOP AN INTERACTIVE SYSTEM THAT HILL ALLOW MEN AND COMPUTERS TO FORM AN EFFECTIVE "INTELLECTUAL PARTNERSHIP." IN ORDER TO DO THIS, THE COMPUTER MUST BE USED AS A TOOL TO ALLOW MAN TO INCREASE HIS ACCOMPLISHMENTS. THE WAYS IN WHICH HUMAN INTELLECT CAN BE ENHANCED INVOLVE MORE EFFECTIVE METHODS FOR STRUCTURING, STORING AND RETRIEVING, AND MANIPULATING LARGE AMOUNTS OF INFORMATION. THIS PAPER DESCRIBES CURRENT DEVELOPMENTS IN THESE AREAS.

6P, OR.

THIS PAPER PRESENTS A BRIEF, NON-TECHNICAL INTRODUCTION TO THE PHYSICAL LAYOUT OF THE AUGMENTED HUMAN INTELLECT RESEARCH CENTER AT STANFORD RESEARCH INSTITUTE AND TO THE TYPE OF RESEARCH BEING CONDUCTED THERE. CURRENT DEVELOPMENTS IN STRUCTURING, STORING, RETRIEVING, AND MANIPULATING INFORMATION ARE DESCRIBED AND THE RATIONALE UNDERLYING THESE DEVELOPMENTS IS BRIEFLY CONSIDERED. ALTHOUGH THIS PAPER WOULD NOT BE RELEVANT TO THOSE WHO WANT MORE TECHNICAL DESCRIPTIONS OF THIS RESEARCH, IT DOES PROVIDE A CONCISE AND EASY-TO-READ INTRODUCTION TO THIS ON-GOING RESEARCH PROJECT.

207 GENERAL DISCUSSION OF MAN-COMPUTER INTERFACE
HAENDLER, W. MAN-MACHINE INTERFACE. IN H.F. VESSEY & I.J. GABELMAN (EDS.),
STORAGE AND RETRIEVAL OF INFORMATION: A USER-SUPPLIER DIALOGUE. PROCEEDINGS
OF A SYMPOSIUM SPONSORED BY THE AVIONICS AND TECHNICAL INFORMATION PANELS,
ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, NORTH ATLANTIC TREATY
ORGANIZATION (AGARD CONFERENCE PROCEEDINGS NO. 39, NTIS NO. AD 697621), MUNICH,
GERMANY, JUNE 1968, PP. 169-178.
DESCRIPTION:

THE PROBLEM OF THE MAN-MACHINE INTERFACE IS TRACED BACK TO THE TIME WHEN THE FIRST COMPUTERS WERE DESIGNED. IN OVERCOMING THE PROBLEMS OF THE INTERFACE THE CATHODE-RAY TUBE DISPLAY IS OF PRIME IMPORTANCE. USING THE DISPLAY SCREEN IT IS POSSIBLE TO TRANSMIT ALMOST INSTANTANEOUSLY TO MAN ALPHANUMERIC TEXT, BLACK AND WHITE SHADING, SCALED SHADING, COLOURED PICTURES AND MOVING PICTURES. THE MATHEMATICAL THEORY OF AUTOMATA IS OPENING UP NEW WAYS OF EXAMINING THE PROBLEMS IN A FORMAL MANNER. SOLUTIONS TO MANY OF THE PROBLEMS AY THE INTERFACE, HOWEVER, STILL AWAIT BETTER KNOWLEDGE OF HOW INFORMATION PROCESSING TAKES PLACE WITHIN THE HUMAN NERVOUS SYSTEM. (A)

10P, OR.

THIS IS A BRIEF, NON-TECHNICAL DISCUSSION OF MAN-MACHINE INTERFACES WITH SPECIFIC ATTENTION GIVEN TO THE ADVANTAGES AND DISADVANTAGES OF CRT DISPLAYS. ALTHOUGH SOME OF THE AUTHOR'S OBSERVATIONS ARE USEFUL AND PROBABLY VALID, THEY ARE EXPRESSED AS OPINIONS RATHER THAN FACTS. FOR EXAMPLE, IT IS NOTED THAT DYNAMIC DISPLAYS CAN BE MORE EFFECTIVE THAN STATIC DISPLAYS, BUT CARE MUST BE TAKEN TO INSURE DISPLAY CHANGES DO NOT EXCEED MAN'S INFORMATION PERCEPTION AND PROCESSING RATES. IT IS ALSO NOTED THAT THE MAN-MACHINE INTERFACE IS "UNBALANCED", IN THAT MAN IS BETTER AT MAKING QUALITATIVE EVALUATIONS AND THE COMPUTER IS QUANTITATIVELY SUPERIOR AND THAT THIS FACT MAKES IT DIFFICULT FOR MAN TO EXPRESS IDEAS IN A COMPUTER-ACCEPTABLE FORM. OTHER IDEAS EXPRESSED IN THIS PAPER, THOUGH PERHAPS USEFUL, WOULD BE DIFFICULT TO TEST OR IMPLEMENT. EXAMPLES INCLUDE MODELING MAN AS A FINITE STATE AUTOMATON AND DIRECTLY LINKING HUMAN NERVE FIBERS TO A COMPUTER. THIS PAPER IS A FAIRLY DATED DISCUSSION OF MAN-COMPUTER INTERFACES, BUT IT MAY BE OF INTEREST TO THOSE CONCERNED WITH THIS AREA.

208 INTERACTIVE VERSUS MANUAL SCHEDULING

HAIDER, S.W., BUCK, J.R., & MOODIE, C.L. MAN/COMPUTER VERSUS AUTOMATIC SCHEDULING. IN PROCEEDINGS OF THE 21ST ANNUAL MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1977, 100-104. DESCRIPTION:

AUTOMATIC SCHEDULING WAS COMPARED WITH MAN/COMPUTER INTERACTIVE SCHEDULING FOR A SIMULATED JOB SHOP IN EXPERIMENTAL SESSIONS. FACTORS OF THE JOB STREAM WERE CONTROLLED AND THOSE FACTORS WHICH CONTRIBUTED TO IMPROVED MAN/COMPUTER SCHEDULING VERSUS AUTOMATIC SCHEDULING WERE IDENTIFIED. RESULTS SHOW THAT MAN/COMPUTER SCHEDULING GENERALLY WAS SUPERIOR TO AUTOMATIC SCHEDULING; VERY SIGNIFICANTLY IN SEVERAL JOB STREAM SITUATIONS BUT IN ONE SITUATION THE AUTOMATIC METHOD WAS BEST. (A) 5P, 26R.

COMMENTS:

THIS IS A VERY BRIEF DESCRIPTION OF AN EXPERIMENT AND IT APPEARS TO OMIT SEVERAL IMPORTANT DETAILS. FOR EXAMPLE, THE INTERACTIVE SCHEDULING SYSTEM USED IS NOT SUFFICIENTLY DESCRIBED. ASIDE FROM THE FACT THAT THE SYSTEM PROMPTED THE USER WHENEVER IT REQUIRED A DECISION TO BE MADE, IT IS NOT CLEAR WHETHER THIS WAS, IN FACT, AN INTERACTIVE SCHEDULING SYSTEM OR ONLY A VEHICLE FOR MANUAL SCHEDULING. IN ADDITION, THE AUTOMATIC SCHEDULING SYSTEM EMPLOYED WHAT THE AUTHORS REFER TO AS A "HIGHLY REGARDED ALGORITHM" AND THE RESULTS OF THIS EXPERIMENT ARE NOT GENERALIZABLE TO AUTOMATIC SCHEDULING ALGORITHMS, IN GENERAL. ALTHOUGH THIS EXPERIMENT IS POTENTIALLY VERY USEFUL, THIS PAPER IS NOT AN ADEQUATE DESCRIPTION.

209 NATURAL-LANGUAGE PROGRAMMING

HALPERN, M. FOUNDATIONS OF THE CASE FOR NATURAL-LANGUAGE PROGRAMMING. IEEE SPECTRUM, MARCH 1967, 4(3), 140-149.

DESCRIPTION:

THE PURPOSE OF THIS PAPER IS TO CLARIFY SOME OF THE MISCONCEPTIONS THAT IMPEDE USEFUL DISCUSSION OF THE QUESTION OF THE SUITABILITY OF NATURAL LANGUAGE FOR PROGRAMMING. IT IS ARGUED THAT: (1) NATURAL-LANGUAGE PROGRAMMING IS AN ATTEMPT TO PUT NONPROGRAMMERS IN A CLOSER RELATION WITH THE COMPUTER, (2) A NATURAL PROGRAMMING LANGUAGE MUST BE ABLE TO BE WRITTEN EASILY, NOT JUST READ EASILY, (3) PROCESSING NATURAL LANGUAGE IS QUALITATIVELY DIFFERENT FROM (AND EASIER THAN) TRANSLATING ONE LANGUAGE TO ANOTHER, (4) THE REDUNDANCY OF NATURAL LANGUAGE IS AN ADVANTAGE RATHER THAN A DISADVANTAGE, AND (5) NATURAL LANGUAGE PROGRAMMING WILL HELP BRIDGE THE MAN-MACHINE COMMUNICATION GAP.

10P, 17R.

THIS IS AN EXCELLENT AND VERY READABLE DISCUSSION OF THE CONTROVERSY OVER THE USE OF NATURAL LANGUAGE FOR PROGRAMMING. THE AUTHOR'S DISTINCTION BETWEEN "ACTIVE" AND "PASSIVE" LANGUAGES IS USEFUL. HE CITES COBOL AS AN EXAMPLE OF THE LATTER -- A PASSIVE LANGUAGE WHICH IS EASY TO READ, BUT AT LEAST AS DIFFICULT TO WRITE AS OTHER PROGRAMMING LANGUAGES WHICH DO NOT USE A NATURAL-LANGUAGE MODEL. INDEED, SUCH A LANGUAGE MAY VERY WELL COMBINE THE WORST ASPECTS OF NATURAL LANGUAGE WITH THE WORST ASPECTS OF MORE "FORMAL" LANGUAGES. THE AUTHOR ALSO ARGUES THAT GREATER USE SHOULD BE MADE OF REDUNDANCY IN PROGRAMMING LANGUAGES. ONLY VERY SMALL STEPS HAVE BEEN TAKEN IN THIS DIRECTION (E.G., PASCAL, IN WHICH SOME OUT-OF-BOUND ARRAY REFERENCES ARE DETFCTED BY THE COMPILER). OVERALL, THIS IS A VERY GOOD, IF SOMEWHAT CONTROVERSIAL, ANALYSIS WHICH IS OF INTEREST NOT ONLY TO PROGRAMMING LANGUAGE DESIGNERS, BUT POTENTIALLY TO INTERACTIVE DIALOGUE DESIGNERS FOR APPLICATION SYSTEMS AS WELL, AND IS CERTAINLY RELEVANT TO THOSE CONCERNED WITH NATURAL-LANGUAGE DIALOGUE AND PROCESSING.

DECISION PERFORMANCE MEASUREMENT 210 HAMMELL, T.J., PESCH, A.J., & LANE, W.P. DECISION-MAKING PERFORMANCE MEASUREMENT FOR A COMMAND AND CONTROL TRAINING SYSTEM. IN PROCEEDINGS, HUMAN FACTORS SOCIETY, 19TH ANNUAL MEETING. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1975, 315-320.

DESCRIPTION:

A TECHNIQUE HAS BEEN DEVELOPED TO PROVIDE MEASUREMENT OF TACTICAL DECISION-MAKING PEROFRMANCE. A COMPREHENSIVE MATHEMATICAL MODEL OF THE SYSTEM PROVIDES AN ESTIMATE OF THE SYSTEM'S EFFECTIVENESS WITH REGARD TO ACCOMPLISHING SPECIFIC INTERIM AND ULTIMATE TRAINING AND TACTICAL OBJECTIVES. THE EFFECTIVENESS ESTIMATE IS BASED ON PARTICULAR SYSTEM AND SITUATION PARAMETERS. THE RELATIONSHIP BETWEEN THE OPERATOR/TRAINEE'S BEHAVIOR AND CHANGES IN THE SYSTEM PARAMETERS ENABLES THE SYSTEM EFFECTIVENESS VALUES TO PROVIDE A RELATIVE MEASURE OF HUMAN PERFORMANCE. (A)

6P, OR.

THE AUTHORS NOTE THAT PERFORMANCE MEASUREMENT IN COMPLEX TASKS IS VERY

DIFFICULT DUE PRIMARILY TO TWO ASPECTS. FIRST, THERE ARE A LARGE NUMBER OF COMPLEX, RAPIDLY CHANGING PERFORMANCE PARAMETERS TO BE MONITORED AND, PERFORMANCE CRITERIA MAY BE OBSCURE IN TASKS REQUIRING A GREAT DEAL OF COGNITIVE ACTIVITY. MEASURING PERFORMANCE AND PROVIDING APPROPRIATE FEEDBACK TO THE OPERATOR IS ESPECIALLY DIFFICULT IN TASKS THAT ARE CONTINUOUS, RATHER THAN DISCRETE. THE PERFORMANCE MEASUREMENT TECHNIQUE DESCRIBED HERE USES TWO DISPLAYS. ONE DISPLAY PROVIDES TASK-RELEVANT INFORMATION AND THE SECOND PROVIDES GRAPHICAL REPRESENTATIONS RELATING OPERATOR ACTIONS TO VARIOUS PERFORMANCE MEASURES. THE EFFECTIVENESS OF THIS TECHNIQUE DEPENDS, OF COURSE, ON THE PERFORMANCE MACHINES SELECTED. THE IMPLEMENTATION OF THIS TECHNIQUE APPEARS RELATIVELY STRAIGHTFORWARD AND IT APPEARS TO BE FAIRLY USEFUL BOTH IN TRAINING AND OPERATIONAL SITUATIONS.

KEYBOARDS, INTERNATIONAL

HANES, L.F. HUMAN FACTORS IN INTERNATIONAL KEYBOARD ARRANGEMENT. CHAPANIS (ED.), ETHNIC VARIABLES IN HUMAN FACTORS ENGINEERING. BALTIMORE: JOHNS HOPKINS UNIVERSITY PRESS, 1975, 189-206. DESCRIPTION:

THIS ARTICLE DISCUSSES SOME OF THE PROBLEMS INVOLVED IN THE DESIGN OF KEYBOARDS FOR USE BY VARIOUS NATIONAL, CULTURAL, AND LANGUAGE GROUPS. THERE ARE OFTEN CONFLICTS AMONG NATIONAL AND INTERNATIONAL STANDARDS, HISTORICAL PRECEDENTS, FREQUENCY-OF-USE CONSIDERATIONS, AND DESIRES FOR COMMONALITY AND FOR CUSTOMIZATION FOR INDIVIDUAL GROUPS. THE AUTHOR DISCUSSES GUIDELINES FOR KEYBOARD LAYOUT WHICH HAVE BECOME GENERALLY ACCEPTED IN THE UNITED STATES, AS WELL AS VARIOUS COMMON ALPHARETIC AND NUMERICAL KEYBOARD ARRANGEMENTS AND SUGGESTS THAT THE DESIGN CONSIDERATIONS AND PROCEDURES WHICH HAVE PROVEN APPROPRIATE AT A NATIONAL LEVEL ARE PROBABLY ALSO APPROPRIATE WHEN DESIGNING KEYBOARDS FOR VARIOUS NATIONAL AS EXAMPLES, 15 NCR ACCOUNTING SYSTEM KEYBOARDS, DESIGNED FOR SUCH COUNTRIES AS THE U.S., SPAIN, THE UNITED KINGDOM, GERMANY, FRANCE, AND JAPAN, AND FOR ARABIC, HEBREW, AND GREEK (AMONG OTHERS) ARE SHOWN. THE KEYBOARDS HAVE SIMILAR KEY POSITIONS, BUT DIFFERENT ALLOCATIONS OF CHARACTERS TO KEYS. 24P, 19R.

COMMENTS:

THIS PAPER PROVIDES A GOOD GENERAL INTRODUCTION TO THE PROBLEMS OF KEYBOARD THIS PAPER PROVIDES A GOOD GENERAL INTRODUCTION TO THE PROBLEMS OF KETBOARD DESIGN FOR VARIOUS NATIONAL GROUPS. IT IS WRITTEN FROM THE VIEWPOINT OF A MANUFACTURER ATTEMPTING TO DEVELOP SIMILAR VERSIONS OF A SINGLE SYSTEM FOR USE BY VARIOUS NATIONAL GROUPS, BUT SHOULD ALSO BE USEFUL TO ANYONE INVOLVED IN THE DEVELOPMENT OF A SYSTEM TO BE USED BY A SINGLE NATIONAL GROUP OTHER THAN HIS OWN. WHILE IT ADVOCATES A GENERAL APPROACH TO KEYBOARD DESIGN, IT REGARDS THE DETAILS OF SUCH DESIGNS AS SITUATION-SPECIFIC, AND DOES NOT ATTEMPT VERY SPECIFIC GUIDELINES. AS AN INTRODUCTION TO THE TOPIC, THIS ARTICLE IS FINE; FOR ACTUAL DESIGN WORK, IT SHOULD BE SUPPLEMENTED AT LEAST BY SUCH MORE DETAILED GUIDELINES AS D.G. ALDEN, R.W. DANIELS, & A.F. KANARICK (1972) AND R. SEIBEL (1972).

212 DATA ENTRY BY KEYBOARD OR OPTICAL SCANNER
HANES, L.F., & KINKEAD, R.D. RESEARCH IN MANUAL DATA ENTRY (NCR HUMAN FACTORS
REPORT AT-47-18). DAYTON, OHIO: NATIONAL CASH REGISTER CO., OCTOBER 1971
(PAPER PRESENTED AT MEETING OF THE HUMAN FACTORS SOCIETY, NEW YORK, OCTOBER
1971).

DESCRIPTION:

THIS REPORT PRESENTS A DEFINITION OF TWO TYPES OF MANUAL DATA ENTRY, AND PROVIDES RESULTS OF SEVERAL KEYBOARD AND SCANNER DATA ENTRY EXPERIMENTS. RESULTS FOR THE KEYBOARD STUDIES ARE PRESENTED AS DIGRAM DISTRIBUTIONS. SCANNER RESULTS ARE PRESENTED IN TERMS OF ENTRY RATE AND ACCURACY, AND IN COMPARISON WITH KEYBOARD PERFORMANCE. (A)

THE PRINCIPAL RESULTS ARE: (1) A NON-BUFFERED KEYBOARD DECREASES THE ENTRY

THE PRINCIPAL RESULTS ARE: (1) A NON-BUFFERED KEYBOARD DECREASES THE ENTRY RATE OF ALPHA MATERIAL BUT DOES NOT AFFECT EITHER NUMERIC MATERIAL OR DATA RATE, (2) MANUAL MANIPULATION OF THE DATA FIELD IS SLOWER THAN AUTOMATIC PRESENTATION, AND (3) THE RELATIVE ADVANTAGE OF USING AN OPTICAL SCANNER RATHER THAN A KEYBOARD IS DIRECTLY RELATED TO THE LENGTH OF THE DATA FIELD. 20P, SR.

COMMENTS:

THIS PAPER SUMMARIZES SEVERAL EXPERIMENTS THAT HAVE NOT BEEN REPORTED ELSEWHERE. THE PROCEDURES USED IN THESE EXPERIMENTS ARE NOT DESCRIBED IN SUFFICIENT DETAIL TO ALLOW THE READER TO DETERMINE WHAT SPECIFIC TYPES OF DATA ENTRY DEVICES WERE EMPLOYED OR THE EXPERIENCE LEVELS OF THE SUBJECTS. THE REPORTED DATA, THEREFORE, SHOULD BE USED TO INDICATE TRENDS AND RELATIVE DIFFERENCES IN EXPERIMENTAL MANIPULATIONS RATHER THAN AS ABSOLUTE VALUES OF DATA ENTRY PERFORMANCE MEASURES. THESE DATA ARE CLEARLY PRESENTED AND CONSIST PRIMARILY OF FREQUENCY DISTRIBUTIONS OF DIGRAM KEYING TIMES. DATA ARE ALSO PRESENTED ON SPEED AND ACCURACY OF DATA ENTRY WITH AN OPTICAL SCANNER, IN COMPARISON WITH KEYBOARD ENTRY. THIS PAPER WOULD BE A GOOD SOURCE FOR THOSE WISHING INFORMATION ON FACTORS AFFECTING DATA ENTRY PERFORMANCE WITH BOTH KEYBOARDS AND OPTICAL SCANNERS.

213 DECISION AIDS FOR TACTICAL INFORMATION SYSTEMS
HANES, R.M., & GEBHARD, J.W. THE COMPUTER'S ROLE IN COMMAND DECISION. U.S.
NAVAL INSTITUTE PROCEEDINGS, SEPTEMBER 1966, 92(9), 60-68.
DESCRIPTION:

TOO MUCH IS HAPPENING - TOO MUCH CAN HAPPEN - DURING A BATTLE OR AN EXERCISE FOR A COMPUTER TO DIRECT THE COURSE OF ACTION COMPLETELY. EXPERIMENTS WERE CONDUCTED AY THE APPLIED PHYSICS LABORATORY TO DETERMINE TO WHAT DEGREE PRESENT-DAY MACHINES CAN ASSIST THE COMMANDER IN ENGAGING AN ENEMY. (A) 9P, OR.

COMMENTS:

THIS PAPER BRIEFLY DESCRIBES A SERIES OF EXPERIMENTS INVESTIGATING THE USE OF COMPUTERS AS DECISION AIDS IN TACTICAL SITUATIONS. THE BASIC PREMISE OF THIS RESEARCH IS THAT A COMPUTERIZED DEVICE WOULD NEVER BE ALLOWED TO TOTALLY DIRECT ACTIONS IN A TACTICAL SITUATION, BUT SOME TYPE OF COMPUTERIZED DEVICE IS NECESSARY TO INCREASE THE ABILITY OF THE HUMAN COMMANDER TO HANDLE SUCH SITUATIONS. A BASIC CONCERN IN SUCH RESEARCH MUST BE HOW WELL THE COMMANDER CAN INTERACT WITH AND ACCEPT THE AIDS THAT ARE PROVIDED. THAT IS, A DECISION AID, NO MATTER HOW CAREFULLY IT IS DESIGNED, WILL NOT BE EFFECTIVE UNLESS THE HUMAN PROBLEM SOLVER ACCEPTS AND USES IT. THIS PAPER OFFERS SEVERAL USEFUL SUGGESTIONS FOR DESIGNING TACTICAL DECISION MAKING AIDS TO INCREASE USER ACCEPTANCE. IN A TACTICAL SITUATION, THE DECISION AIDS' RECOMMENDATIONS MUST NOT ONLY BE ACCEPTABLE TO THE USER BUT THEY ALSO HAVE TO BE PRESENTED IN SUCH A MANNER THAT AN ACCEPTABLE DECISION CAN BE ACTED UPON IN THE LEAST POSSIBLE TIME. THE AUTHORS OF THIS PAPER RECOMMENDAN "EXECUTE UNLESS REJECTED" MODE OF OPERATION IN WHICH A RECOMMENDED ACTION IS DISPLAYED AND THEN EXECUTED, AFTER A BRIEF DELAY, UNLESS EXPLICITLY REJECTED BY THE HUMAN PROBLEM SOLVER. THIS, AND OTHER, SUGGESTIONS OFFERED IN THIS PAPER SHOULD GREATLY AID BOTH THE EFFECTIVENESS AND USER ACCEPTANCE OF TACTICAL DECISION AIDS.

214 GENERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
HANNEMAN, G.J., & SPINDELL, W.A. HUMAN FACTORS IN AUTOMATED INFORMATION
SYSTEMS. LOS ANGELES, CALIFORNIA: UNIVERSITY OF SOUTHERN CALIFORNIA, ANNENBERG
SCHOOL OF COMMUNICATIONS, JULY 1974.
DESCRIPTION:

THIS IS A PROGRESS REPORT OF WORK DONE IN CONNECTION WITH THE ARPA INFORMATION AUTOMATION PROJECT. IT DISCUSSES ORGANIZATIONAL IMPLICATIONS OF COMPUTER SYSTEMS, DESCRIBES SEVEN SITE VISITS TO NEW INSTALLATIONS, AND CONTAINS CONSIDERABLE GENERAL DISCUSSION RELATING TO RESEARCH AND APPLICATIONS IN THE MAN-COMPUTER INTERACTION AREA. IT ALSO CONTAINS A TAXONOMIZED, ABSTRACTED BIBLIOGRAPHY OF 133 REFERENCES IN THE AREA OF HUMAN FACTORS IN COMPUTER SYSTEMS.

COMMENTS:

THE BULK OF THIS REPORT CONSISTS OF HIGHLY INFORMAL REPORTING OF STAFF ACTIVITIES, SUGGESTIONS, AND IMPRESSIONS. IT IS NOT INTEGRATED IN A FORM USEFUL TO THE GENERAL READER. THE BIBLIOGRAPHY IS SOMEWHAT DISAPPOINTING, AS IT IS HEAVILY CENTERED ON ONE JOURNAL (HUMAN FACTORS), AND INCLUDES MANY VERY REMOTELY RELATED PAPERS FROM THAT JOURNAL WHILE OMITTING MANY HIGHLY RELEVANT PAPERS FROM OTHER SOURCES. THIS REVIEWER IS IN A POSITION TO ASSERT, HOWEVER, THAT THE DEVELOPMENT OF A COMPREHENSIVE BIBLIOGRAPHY OF THIS FIELD INVOLVES QUITE A SIGNIFICANT EFFORT, AND SUCH AN EFFORT MAY HAVE BEEN OUTSIDE THE SCOPE OF THE PROJECT REPORTED HERE. OVERALL, THIS REPORT IS PROBABLY OF INTEREST ONLY TO THOSE INVOLVED WITH THE ARPA PROJECT OF WHICH IT IS A PART.

215 COMPUTER-INITIATED DIALOGUE FOR INTERACTIVE PROGRAMMING
HANSEN, W.J. USER ENGINEERING PRINCIPLES FOR INTERACTIVE SYSTEMS. AFIPS
CONFERENCE PROCEEDINGS, 1971, 39, 523-532.
DESCRIPTION:

THIS PAPER BRIEFLY DESCRIBES THE EMILY TEXT EDITING SYSTEM AND REPORTS A SET OF USER ENGINEERING PRINCIPLES THAT WERE EMPLOYED IN ITS DESIGN. SEVENTEEN PRINCIPLES ARE DISCUSSED UNDER THE GENERAL HEADINGS: (1) KNOW THE USER, (2) MINIMIZE MEMORIZATION, (3) OPTIMIZE OPERATIONS, AND (4) ENGINEER FOR ERRORS.

10P, 16R.

COMMENTS:

THE EMILY TEXT EDITING SYSTEM ALLOWS THE USER TO CONSTRUCT PROGRAMMING LANGUAGE STATEMENTS BY INTERACTING WITH A FORMAL SYNTACTIC GRAMMAR OF THE PROGRAMMING LANGUAGE. A LIGHTPEN, MENU-SELECTION TECHNIQUE CAN BE USED, OR THE USER CAN PRESUMABLY USE THE KEYBOARD INSTEAD. HE MUST, IN ANY CASE, USE THE KEYBOARD FOR INITIAL ENTRY OF VARIABLE NAMES AND CONSTANTS. PRESUMABLY, THE USE OF A COMPUTER-INITIATED DIALOGUE TECHNIQUE MINIMIZES SYNTACTIC ERRORS, SERVES AS A MEMORY AID FOR THE USER, AND REDUCES THE TYPING LOAD FOR INEXPERIENCED TYPISTS. ONE MIGHT SPECULATE, HOWEVER, THAT PROGRAMMER-USERS SOPHISTICATED ENOUGH TO CONSTRUCT PROGRAMS USING A GENERATIVE GRAMMAR ARE PROBABLY EXPERIENCED ENOUGH TO DO IT FASTER, AND PERHAPS BETTER, IN AN OPERATOR-INITIATED DIALOGUE. NO DETAILED SYSTEM EVALUATION RESULTS ARE GIVEN, SO THIS WILL HAVE TO REMAIN A SPECULATION. NOTE THAT S.J. BOIES AND J.D. GOULD (1974) HAVE FOUND SYNTACTIC ERRORS NOT TO BE A MAJOR BOTTLENECK IN SOFTWARE DEVELOPMENT. E.A. YOUNGS (1974) HAS SHOWN THIS TO BE ESPECIALLY TRUE FOR EXPERIENCED PROGRAMMERS. THE USE OF A COMBINED LIGHTPEN-KEYBOARD DIALOGUE ALSO RESULTS IN A GOOD DEAL OF MODE MIXING, WHICH MAY DEGRADE PERFORMANCE SOMEWHAT. WHETHER OR NOT THE SYSTEM IS EFFECTIVE FOR USE BY EXPERIENCED PROGRAMMERS USING FAMILIAR LANGUAGES, EMILY MIGHT BE AN EXCELLENT TOOL FOR LEARNING NEW LANGUAGES.

THE USER ENGINEERING PRINCIPLES DISCUSSED IN THE PAPER ARE AT A VERY HIGH LEVEL, AND CONSTITUTE MORE OF A STATEMENT OF PHILOSOPHY THAN A SET OF SPECIFIC GUIDELINES. THE PHILOSOPHY IS GENERALLY A GOOD ONE, BUT APPEARS TO HAVE BEEN APPLIED SOMEWHAT TOO RIGIDLY (E.G., "SELECTION, NOT ENTRY") IN THE SYSTEM GIVEN AS AN EXAMPLE.

216 STATISTICS ON USER BEHAVIOR IN TIME-SHARING SYSTEM
HARALAMBOPOULOS, G., & NAGY, G. PROFILE OF A UNIVERSITY COMPUTER USER
COMMUNITY. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1977, 9, 287-313.
DESCRIPTION:

THE DATA RECORDED OVER A ONE-YEAR PERIOD ON THE PERMANENTLY MOUNTED SYSTEM MONITOR TAPE AT THE UNIVERSITY OF NEBRASKA IS ANALYZED WITH A VIEW TO DETERMINE PROMINENT COMPUTER USER CHARACTERISTICS. THE USERS ARE DIVIDED INTO DISTINCT CATEGORIES ACCORDING TO THEIR PATTERNS OF COMPUTER RESOURCE UTILIZATION. (A) 27P. 49R.

27P, 49R. COMMENTS:

THIS ANALYSIS IS INTENDED TO INVESTIGATE PATTERNS OF COMPUTER USE BY CATEGORY OF USER. THUS, THE AUTHORS REPORT THE DISTRIBUTION OF USERS IN SUCH CATEGORIES AS COMPILER USED OR NUMBER OF RUNS PER DAY RATHER THAN THE TOTAL NUMBER OF JOBS PROCESSED PER DAY OR THE FRACTION OF COMPUTER RESOURCES CONSUMED IN COMPILATIONS. THE DATA BASE USED IN THIS ANALYSIS IS EXTREMELY LARGE, CONTAINING OVER 2,000,000 RECORDS DESCRIBING ABOUT 450,000 JOBS SUBMITTED BY APPROXIMATELY 5500 USERS. VARIOUS STATISTICS ARE PRESENTED BOTH IN TERMS OF THE AVERAGE USER AND THE AVERAGE JOB SUBMITTED. ALTHOUGH THESE STATISTICS ARE PRESENTED VERY BRIEFLY, THEY DO SUGGEST A VERY HIGH VARIABILITY IN USER DEMANDS ON COMPUTER FACILITIES. SEVERAL SUGGESTIONS ARE MADE FOR IMPROVING CUMPUTER OPERATIONS AT THE COMPUTER CENTER STUDIED.

217 INTERACTION OF DISPLAY ELEMENTS IN COMPLEX DISPLAYS
HARDZINSKI, M., & PACHELLA, R.G. A PSYCHOPHYSICAL ANALYSIS OF COMPLEX
INTEGRATED DISPLAYS (TECHNICAL REPORT NO. 59). ANN ARBOR, MICHIGAN: UNIVERSITY
OF MICHIGAN, DEPARTMENT OF PSYCHOLOGY, FEBRUARY 1977. (NTIS NO. AD A039260)
DESCRIPTION:

FIVE TYPES OF COMPLEX INTEGRATED DISPLAYS WERE SUBJECTED TO MULTIDIMENSIONAL SCALING ANALYSES. THE DISPLAY TYPES WERE SELECTED TO BE REPRESENTATIVE OF A VARIETY OF CHARACTERISTICS THAT CAN RESULT WHEN DIMENSIONS ARE COMBINED IN AN INTEGRATED FASHION. THESE CHARACTERISTICS INCLUDED PERCEPTUAL SEPARABILITY, FAMILIARITY, EMERGENT PROPERTIES AND PERCEPTUAL INTERACTION AMONG DIMENSIONS. OF PRIMARY INTEREST WAS THE QUESTION OF WHETHER OR NOT THE MINKOWSKI SCALING METRIC WOULD BE DIAGNOSTIC OR PREDICTIVE OF ANY OF THESE CHARACTERISTICS, AS PREVIOUS LITERATURE HAS INDICATED. THE RESULTS SHOWED THAT IN VIRTUALLY ALL CASES THE EUCLIDEAN METRIC PRODUCED BETTER FITS THAN THE CITY-BLOCK METRIC. THE QUALITATIVE INTERPRETABILITY OF THE INDIVIDUAL DIMENSIONS OF THE DISPLAY PROVED TO BE OF MUCH GREATER UTILITY FOR ASSESSING PERCEPTUAL CHARACTERISTICS. REPRESENTATIVE ANALYSES OF INDIVIDUAL SUBJECT DATA ARE PRESENTED AND THE IMPLICATIONS OF THE RESULTS FOR DISPLAY DESIGN ARE DISCUSSED. (A)

COMMENTS:

IN MULTIDIMENSIONAL DISPLAYS, THE PHYSICAL DIMENSIONS THAT ARE USED MAY NOT CORRESPOND TO THE PSYCHOLOGICAL DIMENSIONS THAT A SUBJECT PERCEIVES. FOR EXAMPLE, A SUBJECT MAY PERCEIVE TWO DIMENSIONS AS EITHER SEPARABLE OR INTEGRAL. IN THE LATTER CASE, THE INTERACTION OF TWO PHYSICAL DIMENSIONS IS VIEWED, PSYCHOLOGICALLY, AS A SINGLE DIMENSION. ONE INTENT OF SUCH RESEARCH IS THE DEVELOPMENT OF PSYCHOPHYSICAL DATA THAT WOULD ALLOW THE PREDICTION OF RELEVANT PERFORMANCE MEASURES IN TASKS INVOLVING COMPLEX DISPLAYS. FOR EXAMPLE, A DISPLAY DESIGNER COULD PREDICT THE INFORMATION TRANSMITTED BY A DISPLAY, REACTION TIME, ETC. ON THE BASIS OF DISPLAY PROPERTIES ALONE AND WITHOUT ACTUALLY MEASURING HUMAN PERFORMANCE. THIS RESEARCH INDICATES THAT FAIRLY STANDARD MULTIDIMENSIONAL SEALING TECHNIQUES ARE NOT APPROPRIATE WHEN THE DIMENSIONALITY IS HIGH AND BOTH SEPARABLE AND INTEGRAL DIMENSIONS ARE INVOLVED. SINCE DISPLAYS IN SEVERAL SITUATIONS (E.G., TACTICAL INFORMATION SYSTEMS) ARE OF THIS TYPE, THIS SUGGESTS THAT CAREFUL CONSIDERATION, AND PERHAPS EMPIRICAL TESTING, SHOULD BE INVOLVED IN THEIR DESIGN.

218 HUMAN FACTORS IN COMMAND AND CONTROL
HAYES, R., BROWNELL, J., HAYES, J., & SPECTOR, B. HUMAN FACTORS PROBLEMS OF
THE COMMAND, CONTROL, AND COMMUNICATION PROCESS IN THE 1990'S. ARLINGTON,
VIRGINIA: CACI, INC., JULY 1976. (NTIS NO. AD A027420)

DESCRIPTION:

THIS REPORT DESCRIBES RESEARCH COMPLETED ON THE FIRST FOUR TASKS OF A STUDY OF HUMAN FACTORS PROBLEMS OF THE COMMAND, CONTROL, AND COMMUNICATION (C-3) PROCESS OF THE 1990'S. TWO QUITE DIFFERENT DESCRIPTIVE STRUCTURES ARE BUILT THAT WILL INTERACT IN SUBSEQUENT TASKS TO PROVIDE THE STUDY OUTCOME. FIRST, A SET OF HUMAN FACTORS ACTIVITIES INVOLVED IN THE C-3 PROCESS IS ENUMERATED AND THE DETERMINING FORCES CONTROLLING THESE HUMAN FACTORS ARE ELABORATED. SECOND, A LIST OF VARIABLES CONSTITUTING THE SET OF RELEVANT DIMENSIONS OF FUTURE (1990) ENVIRONMENTS FOR C-3 CENTERS IS DEVELOPED, AND, BY ANALYZING THE LITERATURE AND EXPLORING EXPERT OPINION, VALUES FOR THESE VARIABLES ARE SPECIFIED WHICH IN AGGREGATE CONSTITUTE MEANINGFUL ALTERNATIVE FUTURES. (A) 87P, 65R.

COMMENTS:

THE AUTHORS BEGIN BY LISTING WHAT THEY CONSIDER TO BE THE "30 MOST PERTINENT HUMAN FACTORS," VARIABLES THAT AFFECT THESE FACTORS AND HOW THESE FACTORS AFFECT HUMAN PERFORMANCE. THIS DISCUSSION IS HIGHLY SUBJECTIVE AND NO ATTEMPTS ARE MADE TO SUPPORT ANY OF THE AUTHORS' CLAIMS. THE FORECASTS OF SOCIAL, CULTURAL, AND TECHNOLOGICAL CHANGES ARE EQUALLY SUBJECTIVE. THIS PAPER ADDRESSES A REAL CONCERN; THE APPROACH TAKEN, HOWEVER, IS FAR FROM SCIENTIFIC.

219 CRT DISPLAYS

HAYMAN, E. DESIGN CRITERIA FOR CRT ALPHANUMERIC DISPLAYS. IN PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON MAN-MACHINE SYSTEMS, 8-12 SEPTEMBER 1969 (VOL. 4) (IEEE CONFERENCE RECORD NO. 69C58-MMS). NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS, INC., 1969. DESCRIPTION:

CONSIDERATION IS GIVEN, INITIALLY, TO THE PRECISE REQUIREMENTS OF THE HUMAN BEING IN RESPECT OF DISPLAY BRIGHTNESS, FLICKER FREE PRESENTATION, MINIMUM OPERATOR FATIGUE, CHARACTER LEGIBILITY, AND PRECISE CHARACTER PRESENTATION. HAVING ESTABLISHED THE HUMAN PARAMETERS TO BE MET BY A DISPLAY SYSTEM,

HAVING ESTABLISHED THE HUMAN PARAMETERS TO BE MET BY A DISPLAY SYSTEM, EACH PARAMETER IS EXAMINED, AND A PRACTICAL SOLUTION WHICH IS ENGINEERINGLY FEASIBLE, IS SOUGHT AND FOUND. PRECISE CONSIDERATION IS GIVEN TO THE HUMAN REQUIREMENT, WITHOUT COMPROMISE; THE PERFORMANCE OF VARIOUS MAJOR ITEMS FOR THE DISPLAY SYSTEM IS DISCUSSED, AND THE FINAL CHOICE IS MADE. THE LIFETIME OF THESE FINALLY SELECTED ITEMS IS DISCUSSED, IN ORDER TO JUSTIFY CONFIDENCE IN THE SELECTED ITEMS.

FINALLY, THE MODEL DISPLAY IS PRESENTED, THE ASSEMBLY EXPLAINED, AND DEMONSTRATED OPERATIVE. (A)

COMMENTS:

THE HUMAN FACTORS ASPECTS OF CRT DISPLAYS ARE CONSIDERED VERY BRIEFLY AND NO USEFUL GUIDELINES OR CONCEPTS ARE PRESENTED. FOR EXAMPLE, IT IS STATED THAT A DISPLAY SHOULD HAVE NO PERCEPTIBLE FLICKER, BUT THE EFFECTS OF FLICKER OR THE RANGES IN WHICH IT CAN BE DETECTED ARE NOT DISCUSSED. THE MAJOR PART OF THIS PAPER CONSIDERS HOW A CRT DISPLAY SHOULD BE CONSTRUCTED TO GIVE "ACCEPTABLE" PERFORMANCE AT THE LOWEST PRICE. THERE IS NO DISCUSSION OF VARIOUS APPLICATION AREAS AND IT SEEMS VERY UNLIKELY THAT A SINGLE CRT DISPLAY CONFIGURATION WOULD BE OPTIMAL OVER A WIDE RANGE OF APPLICATION AREAS.

220 PERSONALIZED MAN-COMPUTER DIALOGUE

HEAFNER, J.F. A METHODOLOGY FOR SELECTING AND REFINING MAN-COMPUTER LANGUAGES TO IMPROVE USERS' PERFORMANCE (REPORT NO. ISI/RR-74-21). MARINA DEL RAY, CALIFORNIA: UNIVERSITY OF SOUTHERN CALIFORNIA, INFORMATION SCIENCES INSTITUTE, SEPTEMBER 1974. (NTIS NO. AD 787684) DESCRIPTION:

THIS REPORT DESCRIBES A METHODOLOGY (SUPPORTED BY A SOFTWARE PACKAGE) TO MODEL, MEASURE, ANALYZE, AND EVALUATE USERS' PERFORMANCE IN A MESSAGE COMMUNICATION SYSTEM ENVIRONMENT. THE THESES OF THE REPORT ARE: (1) THAT MODELS OF USERS AND SERVICES CAN ACCURATELY BE USED AS PREDICTORS IN SELECTING A LANGUAGE FORM, FOR AN APPLICATION, WHICH WILL RESULT IN HIGH USERS' PERFORMANCE, AND (2) THAT SUCH A LANGUAGE FORM IS ONLY AN APPROXIMATION (IN TERMS OF YIELDING OPTIMAL USER'S PERFORMANCE) DUE TO WITHIN VARIANCES OF USER AND SERVICE-CLASSES, HENCE INDIVIDUAL, ON-LINE REGULATION OF LANGUAGE CONSTRUCTS IS NECESSARY TO FURTHER IMPROVE PERFORMANCE.

THIS REPORT DEVELOPS APPROPRIATE MODELS AND ALGORITHMS, AND STATES HYPOTHESES RELATING THE INTERACTIVE EFFECTS OF USERS, SERVICES, LANGUAGE FORMS, AND OTHER VARIABLES IMPORTANT IN MAN-MACHINE DISCOURSE. AN EXPERIMENTAL DESIGN IS PRESENTED, WHICH TESTS THE MAJOR HYPOTHESES. (A) 64P, 10R.

COMMENTS:

THE IDEA EXPRESSED IN THIS PAPER, THAT USER PERFORMANCE COULD BE IMPROVED BY DEVELOPING AN APPROPRIATE METHODOLOGY FOR DEVELOPING AND DYNAMICALLY ALTERING THE MAN-COMPUTER DIALOGUE TO BEST SUIT THE NEEDS OF EACH INDIVIDUAL USER, IS INTERESTING AND DESERVES CONSIDERATION. THIS PAPER, HOWEVER, DOES NOT PRESENT A COHERENT DISCUSSION OF THIS IDEA OR EVEN CONVINCINGLY DEMONSTRATE ITS FEASIBILITY. ALTHOUGH THE AUTHOR DESCRIBES HOW TO USE A SYSTEM FOR DYNAMIC DIALOGUE ALTERATION, HE DOES NOT ADEQUATELY DESCRIBE EITHER HOW THIS SYSTEM FUNCTIONS OR EXACTLY WHAT IT DOES. THE CONCEPT EXPRESSED IN THIS PAPER REQUIRES ADDITIONAL CONSIDERATIONS OF ITS FEASIBILITY AND USEFULNESS.

221 PROTOCOL ANALYSIS FOR DESIGN OF MAN-COMPUTER DIALOGUE
HEAFNER, J.F. PROTOCOL ANALYSIS OF MAN-COMPUTER LANGUAGES: DESIGN AND
PRELIMINARY FINDINGS (REPORT NO. ISI/RR-75-34). MARINA DEL REY, CALIFORNIA:
UNIVERSITY OF SOUTHERN CALIFORNIA, INFORMATION SCIENCES INSTITUTE, JULY 1975.
(NTIS NO. AD A013568)
DESCRIPTION:

THIS REPORT DESCRIBES AN ON-GOING STUDY IN MAN-MACHINE COMMUNICATIONS. THE STUDY'S MAIN PREMISE IS THAT IN DEVELOPING MAN-COMPUTER LANGUAGES, ONE SHOULD CONSIDER THE USERS' NEEDS AND HABITS, AS WELL AS FEATURES OF THE COMPUTER SERVICE. THE PROBLEM IN DOING SO IS THAT THE DESIGNER DOES NOT MAVE SUFFICIENT QUANTITATIVE INFORMATION ABOUT THE USERS TO ENABLE HIM TO SPECIFY LANGUAGES PERMITTING NEAR-OPTIMAL PERFORMANCE. THE STUDY PROPOSES AND TESTS A METHOD TO ACHIEVE A CLOSER FIT BETWEEN USERS AND THEIR COMPUTER LANGUAGES BY INVOLVING POTENTIAL USERS IN THE DESIGN PROCESS.

TOKEN LANGUAGES OF SEVERAL SYNTACTIC FORMS ARE DEFINED. THEN, RESEARCH HYPOTHESES ARE STATED CONCERNING THE USERS' PREFERENCES REGARDING THE LANGUAGE STRUCTURE AND VOCABULARY. NEXT, AN EXPERIMENT DESIGN IS DESCRIBED, BASED ON A STATISTICAL MODEL OF OBSERVATIONS OF COMMANDS ENTERED BY USERS AS THEY PERFORM A STANDARDIZED TASK. THE METHOD IS TESTED BY PROTOCOL ANALYSIS WITH SUBJECTS WHO ARE POTENTIAL USERS. IN THE PROTOCOL ANALYSIS, SUBJECTS VOCALLY STATED COMMANDS IN EACH OF THE TOKEN LANGUAGES AS THEY PERFORMED THE STANDARDIZED TASK. THESE RESPONDENTS WERE REQUESTED TO CHANGE THE GRAMMAR OF EACH LANGUAGE (DURING THE TASK) TO MAKE IT MORE NATURAL FOR THEM TO USE. THEIR TASK INPUTS WERE USED TO TEST THE HYPOTHESIS. THE REPORT CONCLUDES THAT THE METHOD OF MODELLING USERS AND THEN TESTING DRAFT LANGUAGES IS USEFUL IN LANGUAGE DESIGN, SINCE THERE WAS A CONCENSUS OF USERS' OPINIONS AS TO SPECIFIC LANGUAGE IMPROVEMENTS. (A) 227P, 24R.

## COMMENTS:

AS THE AUTHOR NOTES, PROTOCOL ANALYSIS CAN BE COSTLY, TIME-CONSUMING, AND INCONVENIENT. A PROTOCOL ANALYSIS PROCEDURE CAN ALSO BE SO OBTRUSIVE THAT IT INTERFERES WITH THE BEHAVIOR PATTERNS THAT A SUBJECT WOULD NORMALLY EMPLOY. THIS MAY BE THE CASE HERE SINCE THE "COMPUTER" WAS SIMULATED BY A HUMAN AND THE SUBJECT WAS SURROUNDED BY EXPERIMENTAL OBSERVERS. ON THE OTHER HAND, THIS AND SIMILAR BUT LESS FORMAL "PAPER SIMULATION" TECHNIQUES ARE AN EXCELLENT METHOD FOR INVOLVING THE USER IN THE DESIGN PROCESS AND FOR OBSERVING THE USER'S APPROACH TO PROBLEM SQLVING. THE ANALYSIS INDICATES THAT POSITIONAL NOTATION, KEYWORD NOTATION, AND "ENGLISH-LIKE" LANGUAGES DIFFER WITH RESPECT TO SEVERAL VARIABLES. ALTHOUGH SOME OF THESE VARIABLES AND ASSOCIATED EFFECTS APPEAR TO BE ARTIFACTS OF THE EXPERIMENTAL MATERIALS (E.G., PREFERENCES WITH RESPECT TO THE SPECIFIC COMMAND NAMES USED), OTHERS MAY PROVIDE USEFUL INFORMATION FOR LANGUAGE DESIGN.

222 COMPARISON OF DATA ENTRY DEVICES
HEGLIN, H.J., SABEH, R., & DRIVER, L.L. DIGITAL MESSAGE ENTRY DEVICE (DMED)
HUMAN FACTORS ANALYSIS. IN PROCEEDINGS OF THE 16TH ANNUAL MEETING OF THE
HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1972,

403-409. DESCRIPTION:

THIS REPORT PRESENTS THE RESULTS OF A COMPARISON OF TWO DIGITAL MESSAGE ENTRY DEVICES. THE "MEG" THAT IS CURRENTLY USED BY THE MARINE CORPS CONSISTS OF A SERIES OF ROTARY DIALS FOR DATA ENTRY, THE "AE-MEG" CONSISTS OF A TOUCH SENSITIVE LED MATRIX. THESE DEVICES WERE EVALUATED UNDER TWO LIGHTING CONDITIONS (LIGHT AND DARK WITH RED FLASHLIGHT) AND UNDER TWO MODES OF MESSAGE PRESENTATION (VOICE AND WRITTEN). IT IS CONCLUDED THAT THE AE-MEG IS SUPERIOR TO THE CURRENTLY USED MEG IN BOTH SPEED AND ACCURAGY OF DATA INPUT. SUGGESTIONS FOR FUTURE DEVELOPMENTS WITH DIGITAL MESSAGE ENTRY DEVICES ARE MADE.

COMMENTS:

THE INPUT DEVICES DESCRIBED IN THIS PAPER ARE RELATIVELY NEW AND MAY POTENTIALLY BE USEFUL IN A VARIETY OF SITUATIONS. THE EXPERIMENT DESCRIBED DOES NOT ADEQUATELY COMPARE THESE DEVICES. THE TASK STUDIED INVOLVED SPECIALIZED TERMS AND UNITS OF MEASUREMENT. SINCE NAIVE SUBJECTS WERE USED, AND SINCE ONE OF THE DEVICES USED (MEG) APPEARS TO REQUIRE A MORE THOROUGH UNDERSTANDING OF THESE TERMS THAN THE OTHER, THE RESULTS OF THIS STUDY MAY NOT GENERALIZE TO MORE EXPERIENCED USERS WHO ARE FAMILIAR WITH THESE TERMS. IN ADDITION, THE EXPERIMENTAL DESIGN DID NOT INVOLVE APPROPRIATE COUNTERBALANCING OF CONDITIONS, AND PRACTICE EFFECTS (WHICH ARE PROBABLY LARGE WITH THE SUBJECT POPULATION STUDIED) COULD EASILY CAUSE SPURIOUS SIGNIFICANT DIFFERENCES TO BE RECORDED. NEVERTHELESS, THE SPECIFIC INPUT DEVICES DESCRIBED IN THIS PAPER SHOULD BE OF INTEREST TO THOSE CONCERNED WITH DATA INPUT DEVICES.

223 INTRODUCTION OF AUTOMATED SYSTEMS INTO USER GROUPS
HELPS, F.G. MINIMISING HUMAN PROBLEMS WHEN INTRODUCING AUTOMATION.
APPLIED ERGONOMICS, 1970, 1, 130-133.

DESCRIPTION:

ALTHOUGH CONSIDERABLE THOUGHT HAS BEEN GIVEN TO HUMAN PROBLEMS ARISING FROM THE USE OF AUTOMATION, VERY LITTLE ATTENTION HAS BEEN DEVOTED TO THE HUMAN PROBLEMS ENCOUNTERED DURING ITS INTRODUCTION. THIS ARTICLE REVIEWS VARIOUS STAGES OF THE DESIGN AND INSTALLATION OF AN AUTOMATED SYSTEM FROM THE HUMAN ASPECT. STRESS IS LAID ON THE NEED FOR ERGONOMICS THROUGHOUT ALL PHASES, FROM ANALYSIS OF PRESENT METHODS AND DESIGN OF A NEW SYSTEM TO INSTALLATION, COMMISSIONING AND PERSONNEL SELECTION AND TRAINING. AN ESSENTIAL NEED IS TO INVOLVE ALL LEVELS OF THE NEW SYSTEM'S USERS, FROM MANAGEMENT TO OPERATORS, AT THE EARLIEST OPPORTUNITY. (A) 4P, OR.

COMMENTS:

THIS PAPER PRESENTS A BRIEF, GENERAL OVERVIEW OF THE ROLE OF HUMAN FACTORS SPECIALISTS IN THE DESIGN, IMPLEMENTATION, AND OPERATION OF AUTOMATED EQUIPMENT. THE PRINCIPAL PROBLEM THAT CAN ARISE IN THE INTRODUCTION OF AUTOMATED EQUIPMENT IS THE ABILITY AND WILLINGNESS OF PERSONNEL TO OPERATE THIS EQUIPMENT. THIS PAPER OFFERS SUGGESTIONS ABOUT HOW THIS PROBLEM CAN BE REDUCED BY GIVING MORE CAREFUL ATTENTION TO HUMAN FACTORS ISSUES. ALTHOUGH SOME OF THESE SUGGESTIONS ARE USEFUL (FOR EXAMPLE, EARLY AND CONTINUOUS INTERACTION WITH THE EVENTUAL SYSTEM USERS), THE AUTHOR DOES NOT ATTEMPT TO SUBSTANTIATE THESE IDEAS WITH EXPERIMENTAL OR CASE-STUDY DATA.

RASTER-SCAN CRT DISPLAYS 224

HEMINGWAY, J.C., & ERICKSON, R.A., RELATIVE EFFECTS OF RASTER SCAN LINES AND IMAGE SUBTENSE ON SYMBOL LEGIBILITY ON TELEVISION. HUMAN FACTORS, 1969, 11, 331-338.

DESCRIPTION:

THIS EXPERIMENT EXAMINED THE RELATIVE EFFECTS OF (1) IMAGE SIZE AND (2) NUMBER OF TV RASTER LINES MAKING UP THE IMAGE UPON AN OBSERVER'S ABILITY TO IDENTIFY 16 DIFFERENT GEOMETRIC SYMBOLS ON TV. FOUR RASTER-LINE VALUES PER SYMBOL HEIGHT WERE EACH TESTED AT THREE IMAGE ANGULAR SUBTENSES. EIGH EIGHT SUBJECTS WERE TOLD TO IDENTIFY 25 SYMBOLS FOR EACH OF THE 12 CONDITIONS; ALL HAD 20/12 NEAR AND FAR VISUAL ACUITY OR BETTER. THE FORCED-CHOICE METHOD WAS USED; NO LIMITS WERE PLACED ON RESPONSE TIMES. THE RESULTS SHOWED THAT (1) AT LEAST EIGHT RASTER LINES PER SYMBOL HEIGHT AND (2) A SYMBOL SUBTENCE OF 10° OF ARC ARE NECESSARY TO OBTAIN GOOD SYMBOL LEGIBILITY ON TV. AN EQUATION IS DEVELOPED FROM THESE AND OTHER DATA WHICH QUANTIFIES THE TRADEOFF BETWEEN LINE NUMBER AND ANGULAR SUBTENSE FOR DIFFERENT LEVELS OF PERFORMANCE. (A) 8P, 13R.

COMMENTS:

THIS IS A STRAIGHTFORWARD EXPERIMENT. THE AUTHOR CONCLUDES THAT THERE IS A MULTIPLICATIVE RELATION BETWEEN THE NUMBER OF SCAN LINES AND SUBTENDED ARC OF THE SYMBOLS. THIS IS TRUE, HOWEVER, ONLY OVER A LIMITED RANGE OF NUMBER OF SCAN LINES. BELOW A CERTAIN NUMBER, THERE APPEARS TO BE AN INTERACTION BETWEEN SCAN LINES AND SUBTENDED ARC. THE AUTHOR DOES NOT ANALYZE THESE DATA ON THE BASIS THAT THESE RESULTS ARE "NOT SYSTEMATIC." IT APPEARS, HOWEVER, THAT PERFORMANCE IN THESE CASES IS SIGNIFICANTLY ABOVE CHANCE, INDICATIVE THAT THIS INTERACTION MAY BE REAL AND THE CONSEQUENCES FOR DISPLAY DESIGN SHOULD BE CONSIDERED. IN ADDITION, THE USE OF SUBJECTS WITH ABOVE-NORMAL VISUAL ACUITY MAY PREVENT GENERALIZING THESE RESULTS TO A POPULATION WITH NORMAL VISION, ESPECIALLY IN VIEW OF THE FACT THAT A RE-TEST. OF ONE OF THE EXPERIMENTAL CONDITIONS USING SUBJECTS WITH NORMAL VISUAL ACUITY PRODUCED RESULTS THAT MAY BE DIFFERENT FROM THOSE OBTAINED IN THE ORIGINAL TESTS. THIS DIFFERENCE, HOWEVER, IS NOT ANALYZED IN THIS PAPER.

NATURAL-LANGUAGE PROGRAMMING

HILL, I.D. WOULDN'T IT BE NICE IF WE COULD WRITE COMPUTER PROGRAMS IN ORDINARY ENGLISH -- OR WOULD IT? COMPUTER BULLETIN, JUNE 1972, 16(6), 306-312.

DESCRIPTION:

ONE ARGUMENT THAT IS FREQUENTLY MADE IN FAVOR OF NATURAL-LANGUAGE PROGRAMMING IS THAT PEOPLE SHOULD BE ABLE TO COMMUNICATE WITH COMPUTERS IN THE SAME WAY THAT THEY COMMUNICATE WITH EACH OTHER. WHILE IT IS DESIRABLE TO HAVE A COMMON MODE OF COMMUNICATION, THIS DOES NOT IMPLY THAT WE NEED TO TEACH COMPUTERS ENGLISH; AN ALTERNATIVE IS TO TEACH PEOPLE TO COMMUNICATE WITH EACH OTHER THROUGH UNAMBIGUOUS INSTRUCTIONS. THIS PAPER WILL CONSIDER THE INTRICACIES IN NATURAL ENGLISH THAT PROHIBIT NATURAL LANGUAGE AND SIMULTANEOUSLY ILLUSTRATE THE NEED FOR PEOPLE TO USE PROGRAMMING LANGUAGES IN THEIR INTERACTIONS WITH OTHERS. 7P, 12R.

COMMENTS:

THIS IS A VERY INTERESTING AND EASY TO READ PAPER. THE AUTHOR PROVIDES SEVERAL CLEVER EXAMPLES THAT POINT OUT THE AMBIGUITIES INHERENT IN ENGLISH AND THE NEED FOR CLEARER DESCRIPTIONS OF PROCEDURAL DETAIL IN NATURAL LANGUAGE COMMUNICATION. THE AUTHOR MAY SOMEWHAT OVERSTATE HIS CASE. THE AUTHOR MAY SOMEWHAT OVERSTATE HIS CASE. WHILE IT IS TRUE THAT THERE ARE COMPLICATED AMBIGUITIES IN ENGLISH, RECENT WORK IN ARTIFICIAL INTELLIGENCE HAS DEMONSTRATED SOME SUCCESS IN HANDLING AMBIGUITIES. DEALING WITH AMBIGUITY, HOWEVER, REQUIRES INFERENCE MAKING. THE AUTHOR'S MAIN POINT IS THAT IF COMPUTERS WERE REQUIRED TO MAKE INFERENCES ABOUT THE PROGRAMMER'S INTENT, THEN WE SACRIFICE THE PRECISE AND UNAMBIGUOUS COMMUNICATION OF PROCEDURAL INFORMATION THAT IS ONE OF THE PRINCIPAL ADVANTAGES OF USING A COMPUTER.

226 DATA ENTRY, ERRORS

HINDS, G.H. THE ACCURACY OF DATA PREPARATION. COMPUTER BULLETIN, JUNE 1960, 4, 7-9.

DESCRIPTION:

THIS PAPER IS CONCERNED WITH THE FREQUENCY AND NATURE OF ERRORS IN PUNCHED CARD PREPARATION. DATA WERE OBTAINED FROM FOUR DIFFERENT ORGANIZATIONS. THE TWO MAIN CONCLUSIONS ARE THAT APPROXIMATELY 2% OF THE PUNCHED CARDS HAVE ERRORS THAT ARE DETECTED BY A VERIFIER AND THE PROPORTION OF VERIFIED CARDS THAT CONTAIN ERRORS WHICH ARE LATER DETECTED IS ABOUT 2 PER 10,000. 3P, OR.

COMMENTS:

THE PURPOSE OF THIS PAPER IS TO PRESENT QUANTITATIVE DATA ON THE NATURE OF ERRORS IN PUNCHED CARD DATA ENTRY. THE DATA ARE CLEARLY PRESENTED AND ARE ORGANIZED IN TERMS OF DAY OF THE WEEK, NUMBER OF COLUMNS PUNCHED, NUMBER OF ERRORS DETECTED BY VERIFICATION, TYPE OF ERROR (TRANSCRIPTION OR TRANSPOSITION), ETC. THE AUTHOR DOES NOT, HOWEVER, PRESENT ANY STATISTICAL ANALYSES OF THESE DATA, OFFER ANY DISCUSSION OF THE CAUSES OF ERRORS, OR DESCRIBE THE CONSEQUENCES OF DATA ENTRY ERRORS. #HIS PAPER WOULD BE USEFUL PRIMARILY TO THOSE INTERESTED IN ILLUSTRATIVE DATA ON DATA ENTRY ERRORS.

## 227 DISPLAY FORMATTING

HITT, W.D., SCHUTZ, H.G., CHRISTNER, C.A., RAY, H.W., & COFFEY, L.J.
DEVELOPMENT OF DESIGN CRITERIA FOR INTELLIGENCE DISPLAY FORMATS. HUMAN FACTORS,
1961, 3, 86-92.

DESCRIPTION:

A BROAD RESEARCH PROGRAM TO DEVELOP DESIGN CRITERIA FOR INTELLIGENCE DISPLAY FORMATS IS OUTLINED AND THE GENERAL FINDINGS OF THE PROGRAM ARE DISCUSSED. FIVE SPECIFIC AREAS OF INVESTIGATION ARE SELECTED FOR STUDY: A COMPARISON OF VERTICAL AND HORIZONTAL ARRANGEMENTS OF ALPHA-NUMERIC MATERIAL, AN EVALUATION OF FORMATS FOR TREND DISPLAYS, AN EVALUATION OF METHODS FOR PRESENTATION OF GRAPHIC MULTIPLE TRENDS, AN EVALUATION OF FIVE ABSTRACT CODING METHODS, AND AN EVALUATION OF THE EFFECT OF SELECTED COMBINATIONS OF TARGET AND BACKGROUND CODING ON MAP READING PERFORMANCE. (A)

THIS PAPER DISCUSSES THE METHODOLOGY OF THESE FIVE STUDIES. THE STUDIES ARE REPORTED IN DETAIL IN FIVE OTHER ARTICLES IN THE SAME ISSUE OF THIS JOURNAL.

7P, 1R.

COMMENTS:

THIS PAPER CONTAINS A DISCUSSION OF SOME DISPLAY VARIABLES WHICH MIGHT BE EXPECTED TO AFFECT USER PERFORMANCE IN CONNECTION WITH ALPHANUMERIC, CARTOGRAPHIC, AND TREND DISPLAYS. IT ALSO DESCRIBES, VERY BRIEFLY, GENERAL RESEARCH STRATEGY AND EXPERIMENTAL METHODS EMPLOYED IN A RESEARCH BECAUSE THERE PROGRAM (THE INDIVIDUAL STUDIES ARE REPORTED SEPARATELY). IS UNDOUBTEDLY CONSIDERABLE INTERACTION AMONG VISUAL AND COGNITIVE FACTORS IN DISPLAYS, THE EMPHASIS IS ON MULTIFACTOR EXPERIMENTS. THE EXPERIMENTAL APPARATUS USED WAS A RATHER PRIMITIVE SLIDE-PROJECTOR DISPLAY, BUT THE RESULTS OF THE STUDIES CONTRIBUTE TO OUR KNOWLEDGE OF DETAILED DISPLAY THIS OVERVIEW PAPER IS OF INTEREST MOSTLY FOR ITS DISCUSSION PROPERTIES. OF RESEARCH STRATEGY AND RELEVANT VARIABLES. THOSE INTERESTED IN A COMPREHENSIVE, MODERN VIEW SHOULD OBVIOUSLY LOOK ELSEWHERE. THIS PAPER WILL INTEREST ONLY THOSE INVOLVED IN A DETAILED REVIEW OF THE DISPLAY LITERATURE, OR IN THE CONDUCT OF DISPLAY RESEARCH. THE INDIVIDUAL STUDY REPORTS TO WHICH IT POINTS MAY HELP RESOLVE SPECIFIC DISPLAY QUESTIONS FOR THE DISPLAY DESIGNER, HOWEVER.

228 COMMUNICATION WITH REMOTE USERS

HITTEL, L.A. SOME PROBLEMS IN DATA COMMUNICATIONS BETWEEN THE USER AND THE AFIPS CONFERENCE PROCEEDINGS, 1966, 29, 395-402. DESCRIPTION:

THE EVER INCREASING UTILIZATION OF COMPUTER COMPLEXES FROM REMOTE SOURCES IMPOSES A NEW DIMENSION TO THE ALMOST OVERBURDENING TASK OF SYSTEM DESIGN. REMOTELY ACCESSED SYSTEMS REQUIRE A TIGHT INTEGRATION OF COMMUNICATIONS SERVICES AND EQUIPMENT IN ORDER TO EFFECT A SYSTEM WHICH IS BOTH EFFICIENT AND RESPONSIVE.

THIS PAPER IS A TUTORIAL ATTEMPT TO ACQUAINT THE COMPUTER SYSTEM PLANNER WITH THE EXTRA SEGMENTS OF SYSTEM IMPLEMENTATION NECESSITATED BY THE DESIRE TO SERVE REMOTE USERS. TIME-SHARING SYSTEMS, DIRECT-ACCESS SYSTEMS, AND MANAGEMENT INFORMATION SYSTEMS WILL REQUIRE AN EVER INCREASING PENETRATION INTO THE WORLD OF DIGITAL COMMUNICATIONS.
FOUR CHRONOLOGICAL PHASES IN THE DEVELOPMENT OF A COMMUNICATIONS-DRIENTED

COMPUTER SYSTEM WILL BE EXAMINED. (4)

8P, OR.

COMMENTS:

THIS PAPER DISCUSSES HARDWARE AND SOFTWARE ASPECTS OF TIME-SHARING SYSTEMS. ALTHOUGH DATED, SOME OF THE CONCEPTS DESCRIBED ARE STILL APPLICABLE TO THE CURRENT STATE OF THE ART IN THIS AREA. NO SERIOUS CONSIDERATION, HOWEVER, IS GIVEN TO HUMAN FACTORS ISSUES.

EVALUATION OF INFORMATION RETRIEVAL SYSTEMS HJERPPE, E.R., & LINDRVIST, M.G. A MODEL FOR THE EVALUATION OF INFORMATION-RETRIEVAL SYSTEMS CONSIDERING THE DECISION SITUATION OF THE USER. PROCEEDINGS OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE, 1971, 8, 77-81. DESCRIPTION:

MOST EVALUATION STUDIES SO FAR HAVE MOSTLY BEEN CONCERNED ONLY WITH THE MEASUREMENT OF TWO VERY SPECIFIC PERFORMANCE PARAMETERS, I.E. PRECISION THESE TWO PARAMETERS ARE ONLY CONCERNED WITH THE SELECTION PROCESS WITHIN THE PROCESS OF INFORMATION RETRIEVAL. THEY ARE RELICTS FROM THE TIMES OF STATIC, INDEXED COLLECTIONS WITH CARD-CATALOGS AND ARE MOSTLY OF INTEREST TO INDEXERS AND SYSTEMS EVALUATORS FROM WITHIN THE SYSTEM.

AN IR-SYSTEM CAN BE EVALUATED IN MANY DIFFERENT CONTEXTS AND FOR DIFFERENT PURPOSES, WITH DIFFERENT GOALS. EACH OF THESE EVALUATIONS MUST USE DIFFERENT MEASURES OF DIFFERENT PARAMETERS. WHEN AN IR-SYSTEM IS EVALUATED FROM THE USERS' POINT OF VIEW, THE PARAMETERS USED FOR THE EVALUATION MUST BE BASED ON HUMAN FACTORS, INFORMATION NEEDS AND USES, AND COMMUNICATION THEORY. (A) 5P, 9R.

COMMENTS:

THIS PAPER DESCRIBES A TECHNIQUE FOR EVALUATING AN INFORMATION RETRIEVAL SYSTEM, WITH PRIMARY EMPHASIS ON THE USER'S NEEDS. THE AUTHORS IDENTIFY SEVERAL CHARACTERISTICS OF THE DECISION SITUATION OF THE USER AND RELATE THESE CHARACTERISTICS TO DESIRED SYSTEM CHARACTERISTICS. ALTHOUGH IT COULD BE ARGUED THAT NEITHER THE LIST OF SYSTEM CHARACTERISTICS NOR THE LIST OF DECISION SITUATION CHARACTERISTICS IS COMPLETE, THEY DO PROVIDE A CONVENIENT "CHECKLIST" THAT COULD BE VERY USEFUL IN THE DESIGN OF INFORMATION RETRIEVAL SYSTEMS.

230 TOUCH PANEL FOR GRAPHICAL INPUT
HLADY, A.M. A TOUCH SENSITIVE X-Y POSITION ENCODER FOR COMPUTER INPUT.
AFIPS CONFERENCE PROCEEDINGS, 1969, 35, 545-551.
DESCRIPTION:

THIS PAPER DISCUSSES THE PRINCIPLES OF OPERATION OF A TOUCH-SENSITIVE GRAPHICAL INPUT DEVICE BASED ON ECHO RANGING OF ULTRASONIC SURFACE WAVES. ALTHOUGH IT IS PRIMARILY CONCERNED WITH THE HARDWARE, THE PAPER BRIEFLY DISCUSSES SOME OF THE FUNCTIONAL CONSIDERATIONS ASSOCIATED WITH SUCH DEVICES.

7P, 7R.

COMMENTS:

AN INTERESTING ASPECT OF THE TOUCH-PANEL DESCRIBED HERE IS THAT THE ENTIRE PANEL IS TOUCH SENSITIVE RATHER THAN ONLY A LIMITED NUMBER OF POINTS OR STRIPS. ALTHOUGH THE AUTHOR DEMONSTRATES THAT SUCH A DEVICE IS TECHNOLOGICALLY FEASIBLE, HE DOES NOT ADDRESS HUMAN FACTORS ISSUES IN ANY DETAIL. IT SEEMS LIKELY, HOWEVER, THAT TOUCH-PANEL INPUTS WOULD DECREASE THE SPECIAL SKILLS OR KNOWLEDGE REQUIRED FOR EFFECTIVE INTERACTION AND, AS A CONSEQUENCE, INCREASE USEABILITY AND ACCEPTANCE. THESE ASPECTS ARE DISCUSSED IN J.K. JOHNSON (1977).

#### 231 DISPLAY FORMATTING AND CODING

HOISMAN, A.J., HANNAH, L.D., & SCHARF, E. AN EXPERIMENTAL INVESTIGATION OF INTELLIGENCE INFORMATION DISPLAY PARAMETERS (REPORT NO. RADC-TDR-63-378).
GRIFFISS AIR FORCE BASE, NEW YORK: ROME AIR DEVELOPMENT CENTER, SEPTEMBER 1963.
(NTIS NO. AD 422076)
DESCRIPTION:

THE PRIMARY GOAL OF THIS PROJECT WAS THE IDENTIFICATION AND SUBSEQUENT EXPERIMENTAL INVESTIGATION OF INFORMATION PRESENTATION PARAMETERS OF VISUAL DISPLAY METHODS USED BY AIR FORCE INTELLIGENCE ANALYSTS.

ON THE BASIS OF AN INTENSIVE ANALYSIS OF DISPLAY METHODS, MAPS, LINEAR GRAPHS, AND TABLES WERE CHOSEN AS THE MOST REPRESENTATIVE MEANS OF DISPLAYING INFORMATION. AN INVESTIGATION OF THE VARIABLES WITHIN THESE METHODS LED TO THE SELECTION OF THE FOLLOWING AS THE MOST POTENTIALLY CRITICAL PARAMETERS: (1) DENSITY -- DEFINED AS THE TOTAL NUMBER OF SYMBOLS IN A GIVEN AREA, (2) DENSITY -- DEFINED AS THE NUMBER OF SYMBOL CLASSES

WITHIN A GIVEN AREA, AND (3) COLOR-CODING.

FIVE EXPERIMENTS WERE CONDUCTED TO COMPARE THESE PARAMETERS, DISPLAY METHODS, AND VARIOUS EXPERIMENTAL TASKS. THE DEPENDENT VARIABLES, IN ALL STUDIES, WERE ACCURACY AND SPEED OF PERFORMANCE. THE MAJOR RESULTS WERE:

(1) INCREASING THE DENSITY OF A DISPLAY (IN TERMS OF BOTH THE ABSOLUTE NUMBER OF SYMBOLS AND THE NUMBER OF SYMBOL CLASSES) RESULTS IN A SYSTEMATIC REDUCTION IN PERFORMANCE, (2) THE ADDITION OF COLOR, AS AN ENHANCEMENT OF A SYMBOL'S DISTINGUISHABILITY, DOES NOT INCREASE PERFORMANCE AND MAY EVEN LESSEN IT, (3) THERE ARE NO DIFFERENCES IN PERFORMANCE BASED ON TASK CATEGORIES, AND (4) TABLES AND GRAPHS DISPLAYING IDENTICAL INFORMATION DO DIFFER MARKEDLY IN TERMS OF PERFORMANCE. WHEN PERFORMANCE IS MEASURED IN TERMS OF SPEED OF RESPONSE, GRAPHS ARE THE MORE EFFECTIVE DISPLAY METHOD; WHEN THE MEASURE IS ACCURACY, THEM TABLES ARE THE BETTER METHOD. (A, ABBR.) 192P, 23R.

COMMENTS:

ALTHOUGH THESE EXPERIMENTS APPEAR TO HAVE BEEN CAREFULLY CONDUCTED AND ANALYZED, THERE IS SOME QUESTION AS TO THE APPROPRIATENESS OF THE EXPERIMENTAL DESIGNS. FOR EXAMPLE, COLOR CODING WAS USED AS A REDUNDANT AND, POSSIBLY, IRRELEVANT VARIABLE RATHER THAN AS A RELEVANT EXPERIMENTAL VARIABLE. IN ADDITION, THE EXPERIMENTAL TASKS WERE SOMEWHAT ARTIFICIAL AND HIGHLY CONSTRAINED AND THIS HAMPERS GENERALIZING THESE RESULTS. IN THE STATISTICAL ANALYSES, A LARGE NUMBER OF SIGNIFICANT EFFECTS WERE FOUND AND THE PRACTICAL SIGNIFICANCE OF THE HIGHER-ORDER INTERACTIONS IS NOT ADEQUATELY CONSIDERED.

232 MAN-COMPUTER PROBLEM SOLVING

HORMANN, A. DESIGNING A MACHINE PARTNER -- PROSPECTS AND PROBLEMS (TECHNICAL REPORT SP-2169/DDD/D1). SANTA MONICA, CALIFORNIA: SYSTEM DEWELOPMENT CORP., OCTOBER 1965. (NTIS NO. AD 626173) DESCRIPTION:

THIS PAPER DISCUSSES SOME POSSIBILITIES FOR EXTENDING MAN'S INTELLECTUAL AND CREATIVE POWER THROUGH "PARTNERSHIP" WITH MACHINES OF INCREASED RESPONSIVENESS AND SOPHISTICATION. SOME OF THE GENERAL REQUIREMENTS FOR A MACHINE PARTNER ARE STATED -- REQUIREMENTS THAT ARE LIKELY TO DIFFER DEPENDING ON THE HUMAN USERS, THEIR PURPOSES, AND THE SITUATIONS. SOME OF THE DIFFERENT PROBLEM DOMAINS ARE DISCUSSED, AND REASONS ARE GIVEN FOR HANDLING SOME PROBLEMS BY MACHINE ALONE, SOME BY A MAN/MACHINE TEAM, AND STILL OTHERS BY MAN ALONE. THIS PAPER ALSO DISCUSSES THE CONCEPTUAL AND TECHNICAL DIFFICULTIES THAT MUST BE OVERCOME BEFORE THE MACHINE CAN BECOME A PARTNER TO MAN, RATHER THAN HIS SIMPLE-MINDED SERVANT. THE PAPER SUGGESTS THE POSSIBILITY OF HAVING "IDEATION SESSIONS" WITH A MACHINE PARTNER IN PROBLEM SITUATIONS REQUIRING NEW IDEAS. THE MACHINE'S CONTRIBUTION MAY BE GREATEST IN THE SECOND PHASE OF PROBLEM SOLVING; I.E., THE JUDICIOUS EVALUATION OF IDEAS AND THE SELECTION OF FRUITFUL ONES FROM A LARGE VOLUME OF DIVERSE IDEAS, BOTH GOOD AND BAD. LAST, THE PAPER DISCUSSES SOME HURDLES THAT MUST BE CROSSED BEFORE MAN CAN ENJOY THE BENEFITS OF MACHINES WORTHY OF THE MAME "PARTNER". (A)

COMMENTS:

THIS PAPER PRESENTS A THEORETICAL FRAMEWORK FOR THE DEVELOPMENT OF MANCOMPUTER PROBLEM SOLVING SYSTEMS. AS STATED IN THIS PAPER, THE BASIC
REQUIREMENT FOR AN EFFECTIVE SYSTEM IS THAT THE COMPUTER AIDS PROVIDED BE
ADAPTABLE TO A GIVEN PROBLEM DOMAIN, IN A VARIETY OF PROBLEM DOMAINS, AND
TO A VARIETY OF USERS. THIS APPEARS TO BE A NECESSARY REQUIREMENT FOR ANY
INTERACTIVE SYSTEM. THE AUTHOR ALSO DISCUSSES PROBLEM DOMAINS AND OFFERS
SUGGESTIONS FOR THE DESIGN OF MAN-COMPUTER PROBLEM SOLVING SYSTEMS.
SINCE THIS PAPER WAS WRITTEN, A GREAT DEAL OF RESEARCH THAT IS RELEVANT
TO MAN-COMPUTER PROBLEM SOLVING HAS BEEN DONE IN THE AREA OF COGNITIVE
PSYCHOLOGY. THE FRAMEWORK PROPOSED IN THIS PAPER IS, THEREFORE, SOMEWHAT
DATED. NEVERTHELESS, IT DOES PRESENT SOME INTERESTING CONCEPTS AND WOULD
BE OF INTEREST TO THOSE CONCERNED WITH MAN-COMPUTER PROBLEM SOLVING.

233 MAN-COMPUTER PROBLEM SOLVING

HORMANN, A. PROBLEM SOLVING AND LEARNING BY MAN-MACHINE TEAMS -- PROGRESS AND PLANNED INVESTIGATIONS (TECHNICAL REPORT SDC-TM-2311/008/00). SANTA MONICA, CALIFORNIA: SYSTEM DEVELOPMENT CORP., JULY 1967. (NTIS NO. AD 676123) DESCRIPTION:

THE PRIMARY OBJECTIVE OF THE RESEARCH DESCRIBED HERE IS TO EXPLORE WAYS IN WHICH A MAN AND AN ADAPTIVE MACHINE CAN BE TEAMED FOR DECISION-MAKING/PROBLEM-SOLVING TASKS IN SUCH A WAY AS TO AUGMENT EACH OTHER'S CAPABILITIES AS THEY LEARN. THE FIRST TWO SECTIONS SUMMARIZE THE MAIN TEXT THAT CONTAINS DESCRIPTIONS OF THE PROGRESS TO DATE AND PLANNED INVESTIGATIONS. (A) 25P, 42R.

COMMENTS:

THIS PAPER PRESENTS SOME POTENTIALLY USEFUL CONCEPTS TO IMPROVE MAN-COMPUTER PROBLEM SOLVING. A SYSTEM IS DESCRIBED THAT AIDS THE HUMAN PROBLEM SOLVER BY GENERATING AND DISPLAYING ALTERNATIVE ACTIONS AND THE CONSEQUENCES OF THESE ACTIONS, ALERTING THE HUMAN PROBLEM SOLVER WHEN USER-DEFINED STATES OF THE PROBLEM ARE ACHIEVED, AND STORING USER-DEFINED INFORMATION. SEVERAL EXTENSIONS TO THIS SYSTEM, CONCERNED WITH USING THE COMPUTER TO "LEARN" USER-DEFINED STRATEGIES, ARE ALSO DISCUSSED. THIS PAPER PROVIDES A DESCRIPTION OF THE EARLY DEVELOPMENTS WITH THE "GAKU" SYSTEM. A MORE RECENT DISCUSSION OF THIS SYSTEM CAN BE FOUND IN A.M. HORMANN (1970, 1971 A,B).

234 MAN-COMPUTER PROBLEM SOLVING

HORMANN, A.M. PLANNING BY MAN-MACHINE SYNERGISM: A CHARACTERIZATION OF PROCESSES AND ENVIRONMENT (REPORT NO. SP-3484/DO/DO). SANTA MONICA, CALIFORNIA: SYSTEM DEVELOPMENT CORP., MARCH 1970. (NTIS NO. AD 704810) DESCRIPTION:

THIS PAPER DESCRIBES AN ATTEMPT TO COUPLE THE COMPLEMENTARY CAPABILITIES OF MAN AND MACHINE IN THE CONTEXT OF PLANNING AND CREATIVE PROBLEM SOLVING. SOME REAL-WORLD PROBLEMS IN WHICH MAN-MACHINE TECHNIQUES CAN BE FRUITFULLY APPLIED ARE CHARACTERIZED AND THE TYPES OF DECISION DYNAMICS INFLUENCED BY THESE CHARACTERISTICS ARE IDENTIFIED. THEN, HOW MAN TENDS TO HANDLE COMPLEXITY AND UNCERTAINTY IS DISCUSSED IN TERMS OF THE CONCEPT OF "COGNITIVE ECONOMY."

NEXT, CHARACTERISTICS OF PLANNING PROCESSES ARE DISCUSSED IN TERMS OF THE HIERARCHICAL, ITERATIVE NATURE OF PLANNING AND THE STAGES OF PROBLEM SOLVING (GOAL SETTING, ALTERNATIVE GENERATION, CONSEQUENCE ESTIMATION, AND EVALUATION AND ALTERNATIVE SELECTION). STRUCTURAL ATTRIBUTES EXTRACTED FROM SUCH CHARACTERIZATION CONSTITUTE THE BASIC FRAMEWORK AND GUIDING MECHANISM FOR INTERACTION IM GAKU, A SYSTEM OF COMPUTER PROGRAMS DESIGNED AS A STEP TOWARD MAN-MACHINE SYNERGISM. FEATURES OF GAKU ARE THEN DESCRIBED IN TERMS OF BOTH BUILT-IN CAPABILITIES THAT ARE RELATIVELY INDEPENDENT AND MAN-MACHINE ACTIONS FOR DYNAMIC EXTENSION OF THESE CAPABILITIES THAT ARE PROBLEM DEPENDENT AND USER ORIENTED. THE LATTER CAN BE SEEN TO MAKE THE SYSTEM DISCRESSINGLY USEFUL AND POWERFUL AS A "CO-EVOLVING" MAN-MACHINE TEAM.

INCREASINGLY USEFUL AND POWERFUL AS A "CO-EVOLVING" MAN-MACHINE TEAM.

COMPELLING REASONS FOR PROMOTING MAN-MACHINE SYNERGISM ARE PRESENTED
IN TERMS OF SERIOUS OR IMPORTANT CONSEQUENCES OF DECISIONS IN REAL-WORLD
PROBLEM SITUATIONS. THE NECESSITY OF ALLOWING VAGUE AND SUBJECTIVE VALUE
JUDGEMENTS TO BE EXPRESSED AND MANIPULATED, ESPECIALLY AT THE EARLY STAGES
OF HIGHER-LEVEL PLANNING, IS STRESSED. TECHNIQUES TO HANDLE THIS ARE
DESCRIBED. (A)

82P, 100R.

COMMENTS:

THIS IS AN EARLIER, AND APPARENTLY IDENTICAL, VERSION OF: HORMANN, A.M. A MAN-MACHINE SYNERGISTIC APPROACH TO PLANNING AND CREATIVE PROBLEM SOLVING: PARTS I AND II. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1971, 3, 167-184, 241-267.

235 MAN-COMPUTER PROBLEM SOLVING

HORMANN, A.M. A MAN-MACHINE SYNERGISTIC APPROACH TO PLANNING AND CREATIVE PROBLEM SOLVING: PART 1. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1971, 3, 167-184.

DESCRIPTION:

MAN AND MACHINE IN THE CONTEXT OF PLANNING AND CREATIVE PROBLEM SOLVING.

IN THIS PAPER, SOME REAL-WORLD PROBLEMS IN WHICH MAN-MACHINE TECHNIQUES

CAN BE FRUITFULLY APPLIED ARE CHARACTERIZED, AND THE TYPES OF DECISION

DYNAMICS INFLUENCED BY THESE CHARACTERISTICS ARE IDENTIFIED. THEN, HOW MAN

TENDS TO HANDLE COMPLEXITY AND UNCERTAINTY IS DISCUSSED IN TERMS OF THE

CONCEPT OF "COGNITIVE ECONOMY". AN ATTEMPT IS MADE TO IDENTIFY THE

INTERDEPENDENCIES OF MAN'S CAPABILITIES AND LIMITATIONS AND THE MACHINE'S

POTENTIAL CAPABILITIES AND LIMITATIONS. DESCRIPTIONS ARE GIVEN OF SEVERAL

THIS PAPER DESCRIBES AN ATTEMPT TO COUPLE THE COMPLEMENTARY CAPABILITIES OF

INTERDEPENDENCIES OF MAN'S CAPABILITIES AND LIMITATIONS AND THE MACHINE'S POTENTIAL CAPABILITIES AND LIMITATIONS. DESCRIPTIONS ARE GIVEN OF SEVERAL GUIDELINES AND TECHNIQUES FOR DE'ELOPING A MAN-MACHINE SYSTEM THAT PROMOTES EFFECTIVE INTERMESHING OF THESE CAPABILITIES. NEXT, THE COMPELLING NEED FOR MAN-MACHINE SYNERGISM IS PRESENTED IN TERMS OF THE SERIOUS CONSEQUENCES OF DECISIONS IN REAL-WORLD PROBLEM SITUATIONS. (A)

PARTS I AND II OF THIS PAPER WERE PREVIOUSLY PRESENTED IN A COMBINED FORM IN HORMANN, A.M. PLANNING BY MAN-MACHINE SYNERGISM: A CHARACTERIZATION OF PROCESSES AND ENVIRONMENT (REPORT NO. SP-3484/000/00). SANTA MONICA, CALIFORNIA: SYSTEM DEVELOPMENT CORPORATION, 1970 (NTIS NO. AD 704810). 18P. 17R.

COMMENTS:

THE FOCUS OF THIS RESEARCH IS ON PLANNING AND CREATIVE PROBLEM SOLVING AND THE TYPES OF COMPUTER AIDS THAT WOULD IMPROVE PERFORMANCE IN THESE AREAS. THE AUTHOR DESCRIBES PHASES OF PROBLEM SOLVING (GOAL SETTING, ALTERNATIVE GENERATION, CONSEQUENCE ESTIMATION, AND EVALUATION AND ALTERNATIVE SELECTION), DISCUSSES DIFFICULTIES THAT CAN ARISE IN EXECUTING THESE PROCESSES AND DESCRIBES (IN PART II OF THE TWO-PAPER SERIES) A PROPOSED SYSTEM (GAKU) THAT IS INTENDED TO REDUCE THESE DIFFICULTIES. ALTHOUGH AREAS OF DIFFICULTY ARE IDENTIFIED, THE SOURCES OF THOSE DIFFICULTIES ARE NOT FULLY EXPLORED AND IT IS NOT POSSIBLE TO DETERMINE FROM THIS PAPER WHETHER THE INTERACTIVE SYSTEM DESCRIBED IN THIS PAPER AIDS IN MAN-COMPUTER PROBLEM SOLVING TASKS. THE AUTHOR HAS ATTEMPTED TO DEVELOP A SYSTEM THAT IS CONSISTENT WITH PSYCHOLOGICAL THEORY. IN THE PAST FEW YEARS MORE GENERAL AND POSSIBLY MORE APPLICABLE THEORIES HAVE BEEN DEVELOPED WHICH COULD LEAD TO THE DEVELOPMENT OF MORE POWERFUL MAN-COMPUTER PROBLEM SOLVING SYSTEMS. NEVERTHELESS, THE METHODOLOGY AND SOME OF THE CONCEPTS PRESENTED IN THIS PAPER WOULD BE RELEVANT TO THOSE INTERESTED IN MAN-COMPUTER PROBLEM SOLVING.

236 MAN-COMPUTER PROBLEM SOLVING

HORMANN, A.M. A MAN-MACHINE SYNERGISTIC APPROACH TO PLANNING AND CREATIVE PROBLEM SOLVING: PART II. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1971, 3, 241-267.

DESCRIPTION:

THIS PAPER DESCRIBES A PROPOSED SYSTEM, GAKU, AS A STEP TOWARD MAN-MACHINE SYNERGISM. CHARACTERISTICS OF PLANNING PROCESSES ARE DESCRIBED IN TERMS OF THE LEVELS OF PLANNING (CONCEPTUAL, DEFINITIONAL, DEVELOPMENTAL, AND OPERATIONAL) AND THE STAGES OF PROBLEM SOLVING (GOAL SETTING, ALTERNATIVE GENERATION, CONSEQUENCE ESTIMATION, AND EVALUATION AND ALTERNATIVE SELECTION). STRUCTURAL ATTRIBUTES EXTRACTED FROM THESE CHARACTERISTICS CONSTITUTE THE BASIC FRAMEWORK AND GUIDING MECHANISM FOR MAN'S INTERACTION WITH GAKU.

AN EXAMPLE OF MAN-MACHINE INTERACTION IS PRESENTED, SUGGESTING DESIRABLE CAPABILITIES OF GAKU. FEATURES OF GAKU ARE THEN DESCRIBED IN TERMS OF BOTH BUILT-IN CAPABILITIES THAT ARE RELATIVELY PROBLEM INDEPENDENT, AND MAN-MACHINE ACTIONS FOR DYNAMIC EXTENSION OF THESE CAPABILITIES THAT ARE PROBLEM DEPENDENT AND USER ORIENTED. THE LATER CAN BE SEEN TO MAKE THE SYSTEM INCREASINGLY USEFUL AND POWERFUL AS A "CO-EVOLVING" MAN-MACHINE TEAM. (A)

27P, 22R.

COMMENTS:

SEE THE COMMENTS ON HORMANN, A.M. A MAN-MACHINE SYNERGISTIC APPROACH TO PLANNING AND CREATIVE PROBLEM SOLVING: PART I. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1971, 3, 167-184.

237 MAN-COMPUTER PROBLEM SOLVING
HORMANN, A.M. PLANNING BY MAN-MACHINE SYNERGISM. IN H. SACKMAN & R.L.
CITRENBAUM (EDS.), ONLINE PLANNING: TOWARDS CREATIVE PROBLEM-SOLVING.
ENGLEWOOD CLIFFS, NEW JERSEY: PRENTICE-HALL, 1972, 69-134.
DESCRIPTION:

THIS PAPER DESCRIBES AN ATTEMPT TO COUPLE THE COMPLEMENTARY CAPABILITIES OF MAN AND MACHINE IN THE CONTEXT OF PLANNING AND CREATIVE PROBLEM SOLVING.

SOME REAL-WORLD PROBLEMS TO WHICH MAN-MACHINE TECHNIQUES CAN BE APPLIED ARE CHARACTERIZED, AND THE TYPES OF DECISION DYNAMICS INFLUENCED BY THESE CHARACTERISTICS ARE IDENTIFIED. THEN, HOW MAN TENDS TO HANDLE COMPLEXITY AND UNCERTAINTY IS DISCUSSED IN TERMS OF THE CONCEPT OF "COGNITIVE ECONOMY." AN ATTEMPT IS MADE TO IDENTIFY THE INTERDEPENDENCIES OF MAN'S CAPABILITIES AND LIMITATIONS. SEVERAL GUIDELINES AND TECHNIQUES FOR DEVELOPING A MAN-MACHINE SYSTEM THAT PROMOTES EFFECTIVE INTERMESHING OF THESE CAPABILITIES ARE DESCRIBED.

NEXT, CHARACTERISTICS OF PLANNING PROCESSES ARE DISCUSSED IN TERMS OF (A) THE LEVELS OF PLANNING (CONCEPTUAL, DEFINITIONAL, DEVELOPMENTAL, AND OPERATIONAL), AND (B) THE STAGES OF PROBLEM SOLVING (GOAL SETTING, ALTERNATIVE GENERATION, CONSEQUENCE ESTIMATION, AND EVALUATION AND ALTERNATIVE SELECTION). STRUCTURAL ATTRIBUTES EXTRACTED FROM SUCH CHARACTERIZATION CONSTITUTE THE BASIC FRAMEWORK AND GUIDING MECHANISM FOR INTERACTION IN GAKU, A SYSTEM OF COMPUTER PROGRAMS DESIGNED AS A STEP TOWARD MAN-MACHINE SYNERGISM. (A, ABBR.) 66P, 113R.

COMMENTS:

THE CONCEPTS AND DISCUSSIONS CONTAINED IN THIS PAPER ARE ESSENTIALLY IDENTICAL TO THOSE CONTAINED IN A.M. HORMANN (1970, 1971A, 1971B).

238 DECISION AIDS FOR TACTICAL INFORMATION SYSTEMS
HOWELL, W.C. SOME PRINCIPLES FOR THE DESIGN OF DECISION SYSTEMS: A REVIEW
OF SIX YEARS OF RESEARCH ON A COMMAND-CONTROL SYSTEM SIMULATION (TECHNICAL
REPORT AMRL-TR-67-136). WRIGHT-PATTERSON AIR FORCE BASE, OHIO: AEROSPACE
MEDICAL RESEARCH LABORATORIES, SEPTEMBER 1967. (NTIS NO. AD 665469)
DESCRIPTION:

A SET OF GENERAL PRINCIPLES FOR GUIDANCE IN DECISION SYSTEM DEVELOPMENT IS PRESENTED BASED UPON RESEARCH FINDINGS OBTAINED IN A SIMULATED (BUT HIGHLY GENERALIZED) COMMAND-CONTROL SYSTEM. THE CHIEF OBJECTIVE OF THE RESEARCH WAS EVALUATION OF AN AUTOMATED PROCEDURE FOR ASSISTING MAN IN MAKING DIAGNOSTIC DECISIONS. BRIEFLY, THIS PROCEDURE INVOLVED AGGREGATION BY THE MACHINE OF HUMAN EVALUATIONS OF A NUMBER OF SEPARATE ITEMS OF RECONNAISSANCE COMPARISONS WERE MADE BETWEEN PERFORMANCE OF THE SYSTEM IN ASSESSING ENVIRONMENTAL STATES (E.G., ENEMY STRATEGIES) WHEN THE AUTOMATED PROCEDURE WAS AND WAS NOT IN EFFECT UNDER A VARIETY OF TASK CIRCUMSTANCES (E.G., LOAD, LEVEL OF INFORMATION FIDELITY, FEEDBACK, ETC.). THE 13 PRINCIPLES THUS FORMULATED GENERALLY SUPPORT THE USE OF AN AUTOMATED AGGREGATION PROCEDURE IN DIAGNOSIS. FURTHERMORE, THEY SHOW THAT MACHINE AGGREGATION IS MOST BENEFICIAL IN CIRCUMSTANCES WHICH PRODUCE LARGE AMOUNTS OF LOW-QUALITY DATA OR THOSE IN WHICH THE HUMAN IS PLACED UNDER SOME SORT OF STRESS. OF THE PRINCIPLES SUGGEST POSSIBLE LIMITATIONS ON THE USE OF MACHINES IN DECISION MAKING. AT PRESENT, FOR EXAMPLE, IT DOES NOT APPEAR ADVISABLE TO AUTOMATE THE FUNCTION OF EVALUATING THE PREDICTIVENESS OF DATA ITEMS. THERE IS ALSO A STRONG POSSIBILITY THAT SOME AGGREGATION BY HUMANS MAY BE DESIRABLE WHEN THERE ARE LARGE QUANTITIES OF DATA TO BE EVALUATED (I.E., IT MAY BE BETTER FOR HUMANS TO EVALUATE DATA ORGANIZED INTO LOGICAL "GROUPINGS" RATHER THAN TO CONSIDER THEM PIECEMEAL -- THUS SHARING IN THE AGGREGATION PROCESS). FINALLY, THERE WOULD SEEM TO BE LITTLE PRACTICAL ADVANTAGE IN AUTOMATING DECISION SYSTEMS WHICH TYPICALLY HANDLE HIGHLY RELIABLE AND PREDICTIVE DATA. 32P, 30R.

COMMENTS

THE "GENERAL PRINCIPLES" DISCUSSED IN THIS PAPER ARE PRIMARILY CONCERNED WITH AUTOMATED AGGREGATION OF DATA AND PROBABILITY ESTIMATION BASED ON BAYES THEOREM. ALTHOUGH IT HAS BEEN DEMONSTRATED THAT, IN CERTAIN TASKS, HUMAN PREDICTIVE BEHAVIOR CAN BE REPRESENTED BY A BAYESIAN MODEL (E.G., A. RAPOPORT, 1964), THE PROBLEM SOLVING PROCESSES LIKELY EMPLOYED IN TACTICAL SITUATIONS ARE MUCH TOO COMPLICATED AND VARIED TO BE ACCURATELY DESCRIBED BY SUCH A MODEL ALONE. ALHHOUGH A SYSTEM IMPLEMENTED ACCORDING TO THESE PRINCIPLES SHOULD AID THE PROBLEM SOLVER IN ACCURATELY DETERMINING THE NATURE OF THE PROBLEM, ESPECIALLY IN SITUATIONS WHERE THERE IS A LARGE AMOUNT OF LOW QUALITY DATA, SUCH AIDS REQUIRE THAT THE PROBLEM SOLVER DETERMINE WHAT AVAILABLE INFORMATION IS RELEVANT RATHER THAN ASSIST IN THIS REGARD.

DECISION AIDS FOR TACTICAL INFORMATION SYSTEMS
HOWELL, W.C., & GETTYS, C.F. SOME PRINCIPLES FOR DESIGN OF DECISION SYSTEMS: A
REVIEW OF THE FINAL PHASE OF RESEARCH ON A COMMAND-CONTROL SYSTEM SIMULATION
(TECHNICAL REPORT NO. AMRL-TR-68-158). WRIGHT-PATTERSON AIR FORCE BASE,
OHIO: AEROSPACE MEDICAL RESEARCH LABORATORIES, NOVEMBER 1968. (NTIS NO.
AD 684548)
DESCRIPTION:

A SET OF GENERAL PRINCIPLES FOR GUIDANCE IN DECISION SYSTEM DEVELOPMENT IS PRESENTED BASED UPON RESEARCH FINDINGS OBTAINED IN A SIMULATED (BUT HIGHLY PRESENTED BASED UPON RESEARCH FINDINGS OBTAINED IN A SIMULATED (BUT HIGHLY GENERALIZED) COMMAND-CONTROL SYSTEM (COMCON). THESE PRINCIPLES SUPPLEMENT A LIST REPORTED EARLIER WHICH GREW OUT OF THE IMMEDIATELY PRECEDING PHASES OF COMCON RESEARCH (W.C. HOWELL, 1967). THE CHIEF OBJECTIVE OF THE PRESENT RESEARCH WAS TO ANTICIPATE A NUMBER OF ISSUES WHICH WOULD ARISE IF AN AUTOMATED AID TO DECISION MAKING WERE ACTUALLY IMPLEMENTED. QUESTIONS ASKED INCLUDED: (1) WHAT HAPPENS TO SYSTEM PERFORMANCE IF PROBABILISTIC INFORMATION IS REDUCED TO AN ALL-OR-NONE FORM AT SOME POINT IN PROCESSING? (2) CAN A HIERARCHICAL (SPECIALIST-NON-SPECIALIST) SYSTEM USE LIMITED RESOURCES EFFECTIVELY TO GATHER PREDICTIVE DATA? (3) CAN A SYSTEM IN WHICH AGGREGATION OF PREDICTIVE INFORMATION IS AUTOMATED BENEFIT FROM A MANUAL SUPPLEMENT (TO HANDLE UNANTICIPATED DATA)? RESULTS SUMMARIZED IN THE NINE PRINCIPLES SUGGEST THAT (1) ALL-NONE TRANSFORMATION OF PROBABILISTIC DATA CAN SERIOUSLY DEGRADE SYSTEM PERFORMANCE, ESPECIALLY IF SYSTEM RESPONSE IS IN ANY WAY DEPENDENT UPON LIKELIHOOD OF ALTERNATIVE STATES (BUT THERE ARE SEVERAL IMPORTANT EXCEPTIONS TO THIS RULE), (2) POTENTIAL DEFICIENCIES IN ALLOCATION OF RESOURCES BY THE SYSTEM SHOULD BE GUARDED AGAINST IN FUTURE SYSTEM DESIGNS, (3) AN AUTOMATED AGGREGATION DESIGN CAN BE ENHANCED BY A MANUAL SUPPLEMENT TO DEAL WITH UNANTICIPATED DATA, (4) A WOICE COMMUNICATION CAPABILITY DOES NOT OFFSET SYSTEM PERFORMANCE DEFICIT ATTRIBUTABLE TO DEGRADATION OF OTHER PROCESSING MODES, AND (5) THE VALUE OF EXPERIENCE IN CERTAIN ASPECTS OF HUMAN DECISION PERFORMANCE MAY NOT EXTEND FAR BEYOND THE SPECIFIC CONDITIONS UNDER WHICH THE EXPERIENCE WAS ACQUIRED. (A) 43P, 14R.

COMMENTS:

THE EXPERIMENTS DISCUSSED IN THIS PAPER ARE DESCRIBED IN TOO LITTLE DETAIL TO ALLOW A DETERMINATION OF THEIR APPROPRIATENESS OR VALIDITY. THE PRINCIPAL RESULT OF THIS PAPER, THAT DECISION PERFORMANCE DEGRADES WHEN WORLD SITUATIONS ARE REPRESENTED WITH DETERMINISTIC RATHER THAN STOCHASTIC MODELS, DOES NOT SEEM SURPRISING. THE ISSUE OF AGGREGATING DATA WITH A BAYESIAN MODEL APPEARS OVER-EMPHASIZED RELATIVE TO THE EQUALLY (OR MORE IMPORTANT) ISSUE OF HOW INFORMATION IS SELECTED FOR CONSIDERATION.

240 EFFECTS OF STRESS ON DISPLAY MONITORING
HOWELL, W.C., JOHNSTON, W.A., & GOLDSTEIN, I.L. INFLUENCE OF STRESS
VARIABLES ON DISPLAY DESIGN (TECHNICAL REPORT RADC-TR-66-42). GRIFFISS AIR
FORCE BASE, NEW YORK: ROME AIR DEVELOPMENT CENTER, APRIL 1966. (NTIS NO.
AD 481509)

NINE EXPLORATORY STUDIES AND FIVE FORMAL EXPERIMENTS WERE CONDUCTED TO DETERMINE (A) WHETHER STRESS DECREMENTS OCCUR IN A COMPLEX DISPLAY MONITORING SITUATION, (B) IF SO, WHAT VARIABLES CONTRIBUTE MOST TO THESE DECREMENTS, AND (C) WHAT CONDITIONS -- PARTICULARLY DISPLAY CONDITIONS -- MAY BE INTRODUCED TO REDUCE SUCH DECREMENTS. VARIABLES STUDIED INCLUDED STIMULUS DENSITY; SIGNAL FREQUENCY, KIND, AND PREDICTABILITY; IRRELEVANT SIGNAL CHARACTERISTICS; DISPLAY FORMAT; DURATION OF MONITCRING; AND RESPONSE REQUIREMENTS.

THE MAJOR FINDINGS SUGGESTED THAT (A) SERIOUS STRESS DECREMENTS DO OCCUR, BUT THESE ARE NOT SIMPLE MONOTONIC FUNCTIONS OVER TIME; (B) DECREMENTS ARE MOST SEVERE UNDER CONDITIONS OF HIGH DISPLAY DENSITY AND LOW SIGNAL FREQUENCY, PARTICULARLY WHEN PREDICTABILITY OF SIGNAL OCCURRENCE IS LOW AND IRRELEVANT INFORMATION IS PRESENT; (C) PERFORMANCE DOES NOT SEEM TO DETERIORATE OVER WEEKS OR MONTHS OF DAILY MONITORING SESSIONS; (D) DISPLAY FORMATS IN WHICH CLASSES OF INFORMATION ARE SEPARATED SPATIALLY OR IN WHICH SOME SPATIAL COMPRESSION IS INTRODUCED SEEM TO REDUCE DECREMENTS AND ENHANCE OVERALL PERFORMANCE. IMPLICATIONS OF THESE AND OTHER MORE TENTATIVE FINDINGS ARE DISCUSSED RELATIVE TO THE PROBLEM OF DISPLAY DESIGN AND FUTURE RESEARCH. (A)

COMMENTS:

DESCRIPTION:

THE EXPERIMENT DESCRIBED IN THIS PAPER APPEARS TO HAVE BEEN CAREFULLY CONTROLLED AND THE RESULTS ARE PRESENTED IN A CLEAR, CONCISE MANNER. ONE RESULT OF THIS RESEARCH IS THAT MONITORING PERFORMANCE IS A U-SHAPED FUNCTION; THAT IS, THERE IS AN INITIAL DECREMENT FOLLOWED BY AN IMPROVEMENT AT THE END OF THE EXPERIMENTAL SESSION. ANALYSES OF THIS FINDING INDICATE THAT THIS DECREMENT IS DUE TO PERIODS OF INATTENTION WHICH CAUSE HIGH PERFORMANCE VARIABILITY RATHER THAN A GENERAL DECREASE IN PERFORMANCE. THIS PAPER ILLUSTRATES THAT SERIOUS STRESS DECREMENTS DO OCCUR IN MONITORING TASKS, THAT THE CONDITIONS RESPONSIBLE FOR THESE DECREMENTS CAN BE ISOLATED, AND THAT DISPLAY CHARACTERISTICS TO COUNTER THESE DECREMENTS CAN BE IDENTIFIED. THIS PAPER ALSO CONTAINS SEVERAL SUGGESTIONS FOR ADDITIONAL RESEARCH IN THIS AREA.

GLARE AND REFLECTIONS IN CRT TERMINALS
HULTGREN, G.V., & KNAVE, B. DISCOMFORT GLARE AND DISTURBANCES FROM LIGHT
REFLECTIONS IN AN OFFICE LANDSCAPE WITH CRT DISPLAY TERMINALS. APPLIED
ERGONOMICS, 1974, 5, 2-8.
DESCRIPTION:

IN THE PRESENT INVESTIGATION, THE LIGHTING WAS STUDIED IN AN OFFICE LANDSCAPE EQUIPPED WITH 17 CRT DISPLAY TERMINALS. COMPLAINTS FROM THE PERSONNEL WERE ANALYSED AND COMPARED WITH THE RESULTS OBTAINED. DISCOMFORT GLARE AND REFLECTIONS ON THE SCREEN WERE FOUND TO BE THE MAIN CAUSES OF THE COMPLAINTS. DISCOMFORT GLARE RESULTED FROM THE DIFFERENCE IN LUMINANCE BETWEEN THE DARK SCREEN AND OTHER LIGHT SURFACES IN THE ROOM. REFLECTIONS FROM WINDOWS AND CEILING LIGHTING DEVELOPED ON THE GLOSSY SCREEN AND WERE OFTEN FOUND TO HAVE HIGHER LUMINANCE VALUES THAN THE TEXT ON THE SCREEN. ON THE BASIS OF THE PRESENT RESULTS, GUIDING PRINCIPLES ARE SUGGESTED FOR THE DESIGN OF LIGHTING IN SIMILAR WORKING PLACES. (A)

7P, 6R. COMMENTS:

THIS REPORT IS MORE AN INFORMAL DBSERVATION THAN A FORMAL, CONTROLLED INVESTIGATION. IT IS NOT SURPRISING THAT GLARE AND REFLECTIONS CAUSE DISCOMFORT TO PERSONNEL WORKING WITH CRT DISPLAYS OR THAT GLARE AND REFLECTIONS ARE RELATED TO LIGHT SOURCES. IT IS RECOMMENDED THAT CRT DISPLAYS NOT BE PLACED NEAR WINDOWS AND THAT GENERAL ILLUMINATION SHOULD BE LOWERED. THESE RECOMMENDATIONS ARE OBVIOUSLY SOUND, BUT THEY ADD LITTLE TO OUR KNOWLEDGE OF WORKPLACE DESIGN. A MORE THOROUGH DISCUSSION OF THIS TOPIC, ALTHOUGH ALSO LACKING EMPIRICAL EVIDENCE TO SUPPORT THE CONCLUSIONS, IS PRESENTED IN OESTBERG (1976).

242 QUESTIONNAIRE EVALUATION OF MANAGEMENT INFORMATION SYSTEMS IGERSHEIM, R.H. MANAGERIAL RESPONSE TO AN INFORMATION SYSTEM. AFIPS CONFERENCE PROCEEDINGS, 1976, 45, 877-882. DESCRIPTION:

ONE OF THE MOST COMMON PROBLEMS IN IMPLEMENTING A SUCCESSFUL INFORMATION SYSTEM IS ITS THREATENING NATURE TO USERS OF THE SYSTEM -- PARTICULARLY MIDDLE MANAGERS. THE BEHAVIORAL IMPLICATIONS INHERENT IN THE IMPLEMENTATION OF AN INFORMATION SYSTEM WERE STUDIED BY TESTING THE FOLLOWING TWO PROPOSITIONS: (1) ACCEPTANCE OF AN INFORMATION SYSTEM IS POSITIVELY RELATED TO INVOLVEMENT IN THE IMPLEMENTATION OF THE INFORMATION SYSTEM, AND (2) ACCEPTANCE OF AN INFORMATION SYSTEM IS NEGATIVELY RELATED TO THE PERCEPTION OF THE SYSTEM AS THREATENING. THREE HUNDRED THIRTY ONE MIDDLE MANAGERS FROM FIVE DIFFERENT ORGANIZATIONS WERE SAMPLED. AN OVERALL RESPONSE RATE OF 72 PERCENT WAS ACHIEVED UTILIZING AN ANONYMOUS THREE-PART QUESTIONNAIRE. VARIOUS STATISTICAL TECHNIQUES WERE UTILIZED TO VALIDATE THE PROPOSED SCALES USED IN TESTING THE HYPOTHESES.

BASED UPON THE DATA ANALYSIS, THE TWO PROPOSITIONS ARE STRONGLY SUPPORTED. THERE IS A DEFINITE POSITIVE RELATIONSHIP BETWEEN A MIDDLE MANAGER'S ACCEPTANCE OF AN INFORMATION SYSTEM AND HIS PARTICIPATION IN THE ANALYSIS AND DESIGN OF THE SYSTEM. IN ADDITION, THERE IS A NEGATIVE RELATIONSHIP BETWEEN A MANAGER'S ACCEPTANCE OF AN INFORMATION SYSTEM AND THE PERCEIVED THREAT OF THE SYSTEM TO SUCH BEHAVIORAL FACTORS AS JOB SALISFACTION, JOB SKILL, JOB OPPORTUNITY, JOB ORIGINALITY, JOB STATUS, AND JOB SALARY. (A)

COMMENTS:

QUESTIONNAIRE STUDIES OF THIS SORT ARE INHERENTLY LIMITED BY THE FACT THAT THEY INQUIRE INTO THE USER'S SELF-REPORTED ATTITUDES, RATHER THAN OBJECTIVE MEASURES OF HIS BEHAVIOR WITH RESPECT TO A SYSTEM. EXCEPT FOR THIS BASIC LIMITATION, THOUGH, THE ANALYSIS REPORTED IN THIS PAPER APPEARS TO HAVE BEEN WELL DONE AND CLEARLY SUPPORTS THE AUTHOR'S CONCLUSIONS. THE HIGH CORRELATION BETWEEN USER ACCEPTANCE AND USER INVOLVEMENT IN SYSTEM IMPLEMENTATION IS PROBABLY TRUE OF ALL MAN-COMPUTER SYSTEMS AND NOT JUST OF MANAGEMENT INFORMATION SYSTEMS IN PARTICULAR. K.D. EASON (1976) POINTS OUT SEVERAL FACTORS THAT REDUCE ACCEPTANCE OF MANAGEMENT INFORMATION SYSTEMS; INVOLVING THE MANAGER IN SYSTEM DESIGN AND IMPLEMENTATION APPEARS TO BE AN EFFECTIVE TECHNIQUE FOR REDUCING THE EFFECTS OF THESE FACTORS.

243 MAN-COMPUTER INTERFACE IN PROCESS CONTROL

INTERNATIONAL PURDUE WORKSHOP ON INDUSTRIAL COMPUTER SYSTEMS. GUIDELINES FOR THE DESIGN OF MAN/MACHINE INTERFACES FOR PROCESS CONTROL. WEST LAFAYETTE, INDIANA: PURDUE UNIVERSITY, PURDUE LABORATORY FOR APPLIED INDUSTRIAL CONTROL, OCTOBER 1975.

DESCRIPTION:

THE PURPOSE OF THIS DOCUMENT IS TO SERVE AS A GUIDELINE FOR THE DEFINITION OF A COMPUTER-DIRECTED PROCESS CONTROL OPERATOR'S INTERFACE. THIS INTERFACE WILL BE DEFINED AS THE "MAN/MACHINE INTERFACE", OR MMIF.

THIS GUIDELINE IS INTENDED TO BE BOTH PROCESS AND DEVICE INDEPENDENT. IT DEALS WITH THE FUNCTIONAL REQUIREMENTS OF THE INTERFACE AS OPPOSED TO THE DETAILS OF IMPLEMENTATION.

THE GUIDELINE IS ORGANIZED IN A "TOP-DOWN" FORMAT. THE HIGH LEVEL AND PRIMARY DECISIONS RELATING TO THE FUNCTIONS TO BE PERFORMED ARE EXAMINED FIRST. FROM THIS, THE MMIF REQUIREMENTS MAY FINALLY BE DEFINED AND SPECIFIED. (A) 112P, 133R.

COMMENTS:

THIS IS A DOCUMENT OF REMARKABLY WARIED QUALITY. IT DOES NOT CONTAIN "GUIDELINES" IN THE USUAL SENSE, BUT CONSISTS LARGELY OF QUESTIONS INTENDED TO CALL THE DESIGNER'S ATTENTION TO RELEVANT ISSUES. IN SOME CASES, IT IS NOT AT ALL CLEAR WHAT THE DESIGNER WILL DO WITH THE ANSWERS TO THESE QUESTIONS, BUT SUCH A LIST OF ISSUES CAN BE OF ASSISTANCE DURING THE DESIGN OF A SYSTEM. THE DOCUMENT IS SPECIALIZED FOR PROCESS CONTROL, AND IS NOT RECOMMENDED FOR THOSE WITH OTHER APPLICATIONS. THE SECTION ENTITLED "HUMAN FACTORS ENGINEERING" IS RATHER POOR, BUT LATER SECTIONS CONTAIN POTENTIALLY USEFUL HUMAN ENGINEERING DISCUSSIONS UNDER OTHER GUISES.

OVERALL, THE DOCUMENT CONTAINS A FAIR AMOUNT OF INFORMATION WHICH COULD AID THE MAN-COMPUTER INTERFACE DESIGNER OF A PROCESS CONTROL SYSTEM, BUT WEEDING THE USEFUL INFORMATION OUT MAY BE A CHORE. IN PARTICULAR, THE TREATMENT OF OPERATOR PSYCHOLOGY LEAVES A GOOD DEAL TO BE DESIRED, AND MAY MISLEAD THE UNWARY.

244 PROPERTIES OF TARGET DETECTION AIDING SYSTEM
IRVING, G.W. STATISTICAL RESULTS FROM A STUDY COMPARING ALTERNATIVE MMI
DESIGNS FOR SWIMMER DEFENSE SYSTEMS (REPORT NO. 167-8). SANTA MONICA,
CALIFORNIA: INTEGRATED SCIENCES CORP., JULY 1975.
DESCRIPTION:

THIS PAPER DESCRIBES AN EXPERIMENT DESIGNED TO EVALUATE ASPECTS OF THE MAN-MACHINE INTERFACE FOR A SWIMMER DEFENSE SYSTEM. THE INDEPENDENT VARIABLES WERE: (1) FIXED VERSUS VARIABLE SENSOR ALLOCATION, (2) "BAD" VERSUS "MODERATE" SIMULATED ENVIRONMENTAL CONDITIONS, (3) DISPLAY BUFFER SIZE, AND (4) DISPLAY UPDATE INTERVALS. DEPENDENT VARIABLES INCLUDED PROBABILITY OF DETECTING TARGETS AND FALSE ALARMS. THE PRINCIPAL FINDING WAS THAT DETECTION PERFORMANCE CAN BE SIGNIFICANTLY IMPROVED IF THE OPERATOR IS ALLOWED TO VARY PERTINENT SYSTEM OPERATING PARAMETERS IN REAL TIME IN ORDER TO CONTROL THE INFORMATION PRESENTED AT A GIVEN TIME.

COMMENTS:

THIS IS A FAIRLY STRAIGHTFORWARD EXPERIMENT. THERE ARE SOME PROCEDURAL PROBLEMS, HOWEVER, THAT MAY SERIOUSLY IMPACT THE INTERPRETATION OF RESULTS. FOR EXAMPLE, PART OF THE SUBJECTS' PRETRAINING INVOLVED STUDYING A REPORT OF A PILOT EXPERIMENT. THIS EXPOSURE TO EXPERIMENTAL CONDITIONS AND THE RESULTS EXPECTED IN EACH CONDITION COULD EASILY AFFECT SUBJECTS' BEHAVIOR. THE AUTHOR CONCLUDES THAT THE FALSE ALARM RATE DOES NOT VARY AS A FUNCTION OF FIXED OR VARIABLE INTERFACE DESIGN. NO APPROPRIATE ANALYSIS, HOWEVER, IS REPORTED AND THE FACT THAT THE FALSE ALARM RATE WAS APPROXIMATELY TWICE AS HIGH IN THE VARIABLE CONDITION AS IN THE FIXED CONDITION SUGGESTS THAT THIS MAY BE OF CLINICAL, IF NOT STATISTICAL, SIGNIFICANCE. IT WOULD ALSO BE INSTRUCTIVE TO HAVE MORE DATA ON THE RELATION BETWEEN DETECTION PROBABILITY AND FALSE ALARM RATE. FOR EXAMPLE, INCREASING DETECTION PROBABILITY AT THE EXPENSE OF AN INCREASED FALSE ALARM RATE MAY NOT BE ACCEPTABLE IN AN OPERATIONAL ENVIRONMENT. THIS RESEARCH IS WELL MOTIVATED. IT IS AN INTERESTING AND IMPORTANT QUESTION AS TO WHAT INFORMATION SHOULD BE PRESENTED TO AN OPERATOR AND HOW MUCH CONTROL THE OPERATOR SHOULD HAVE OVER INFORMATION PRESENTATION PARAMETERS. THIS EXPERIMENT, HOWEVER, DOES NOT APPEAR TO ADEQUATELY ANSWER THIS QUESTION.

245 GRAPHICAL INPUT OF PROBLEM DESCRIPTION
IRVING, G.W., HORINEK, J.J., CHAN, P.Y., & WALSH, D.H. EXPERIMENTAL
INVESTIGATION OF SKETCH MODEL ACCURACY AND USEFULNESS IN A SIMULATED TACTICAL
DECISION AIDING TASK (TECHNICAL REPORT NO. 215-3). SANTA MOMICA, CALIFORNIA:
INTEGRATED SCIENCES CORP., MAY 1977.
DESCRIPTION:

THIS REPORT DESCRIBES THE IMPLEMENTATION AND EXPERIMENTAL EVALUATION OF A PROPOSED DECISION AID TO SUPPORT NAVAL TASK FORCE COMMANDERS. THE DECISION AID, NAMED THE "SKETCH MODEL," ENABLES A HUMAN OPERATOR TO SPECIFY HIS SUBJECTIVE ESTIMATE OF A MULTIDIMENSIONAL, MULTIMODAL, UNSYMMETRIC THREE-DIMENSIONAL FUNCTION BY ELECTRONICALLY "SKETCHING" ITS TWO-DIMENSIONAL PROJECTION (E.G., ISO-ALTITUDE CONTOURS OF A THREE-DIMENSION FUNCTION) ON A COMPUTER GRAPHICS TERMINAL. THE SKETCH MODEL IS HYPOTHESIZED TO HAVE CERTAIN ADVANTAGES OVER COMPARABLE DECISION AIDING TECHNIQUES (SUCH AS THEORETICAL AND EMPIRICAL OBJECTIVE MODELING AND SCALAR SUBJECTIVE JUDGMENT). THESE ADVANTAGES INCLUDE EASE, SPEED, AND ACCURACY OF ESTIMATION AND OF UPDATING; CONSIDERATION OF QUALITATIVE DATA; AND THE CAPABILITY OF BAYESIAN ESTIMATION WITHOUT EXPLICIT A PRIORI DATA.

FOR THE EXPERIMENTAL EVALUATION, THE SKETCH MODEL TECHNIQUE WAS APPLIED TO THE TACTICAL PLANNING PROBLEM OF OPTIMIZING AN AIR STRIKE PATH. THE GOODNESS OF THE PATH WAS MEASURED BY A UTILITY FUNCTION WHICH CONSIDERED THE CUMULATIVE PROBABILITY OF BEING DETECTED BY ENEMY SENSOR ALONG THE PATH AND THE FUEL CONSUMED ALONG THE PATH. A MULTI-SENSOR COMPOSITE DETECTION RATE SURFACE WAS SKETCH MODELED VIA A COMPUTER GRAPHICS DISPLAY AND PROPOSED STRIKE PATHS WERE DEFINED AND EVALUATED. THE EXPERIMENT CONSISTED OF COLLECTING DATA ON PATH UTILITIES GENERATED BY FOUR DIFFERENT METHODS: (1) OPERATOR-PERFORMED PATH OPTIMIZATION, UNAIDED BY SKETCH MODELS; (2) OPERATOR-PERFORMED OPTIMIZATION AIDED BY OPERATOR'S SKETCH MODELS; (4) COMPUTERIZED OPTIMIZATION AIDED BY OPERATOR'S SKETCH MODELS; (4) DETECTION RATE SURFACE.

AFTER ANALYSIS, THE DATA INDICATED THAT HUMAN OPERATORS WERE ABLE TO PRODUCE ACCURATE (AS MEASURED BY A PERCENT VOLUME ERROR METRIC) SKETCH MODELS OF HIGHLY IRREGULAR MULTI-SENSOR DETECTION RATE FIELDS. THE DATA ALSO SUGGESTED THAT UNDER APPROPRIATE CONDITIONS, AUTOMATED OPTIMIZATION SUPPORTED BY OPERATOR-PERFORMED SKETCH MODELING CAN CONTRIBUTE TO IMPROVED PERFORMANCE OVER CURRENT PROCEDURES. HOWEVER, THE DIFFICULTY OF THE OPTIMIZATION PORTION OF THE EXPERIMENTAL PROBLEMS WAS NOT SUFFICIENT TO PROVIDE A GOOD TEST OF THIS HYPOTMESIS. (A, ABBR.)

## COMMENTS:

THERE ARE SEVERAL ASPECTS OF THIS EXPERIMENT THAT MAKE IT DIFFICULT TO INTERPRET THE RESULTS. TWO SUCH PROBLEMS, NOTED BY THE AUTHORS, INVOLVE THE SMALL NUMBER OF SUBJECTS AND THE FACT THAT THE EXPERIMENTAL PROBLEMS WERE TOO EASY AND ALL SUBJECTS, REGARDLESS OF EXPERIMENTAL CONDITION, ATTAINED VERY HIGH PERFORMANCE SCORES ("CEILING EFFECT"). OTHER PROBLEMS INCLUDE THE USE OF AN ARBITRARY, PERHAPS INSENSITIVE, PERFORMANCE MEASURE AND THE FAILURE TO COUNTERBALANCE THE ORDER OF EXPERIMENTAL CONDITIONS IN A REPEATED MEASURES DESIGN. IN ADDITION, THE TEST OF THE USEFULNESS OF THE SKETCH MODEL IS CONTAMINATED BY THE FACT THAT SUBJECTS WHO WERE PROVIDED WITH THE SKETCH MODEL WERE ALSO PROVIDED WITH OTHER, UNRELATED PROBLEM SOLVING AIDS. ALL OF THESE PROBLEMS, HOWEVER, ARE CORRECTABLE AND THIS EXPERIMENT IS BEST VIEWED AS A PILOT EXPERIMENT WHOSE PURPOSE IS TO INDICATE METHODOLOGICAL PROBLEMS. THE PROBLEM SOLVING AIDS DESCRIBED IN THIS PAPER ARE POTENTIALLY VERY USEFUL, BUT ADDITIONAL EMPIRICAL INVESTIGATIONS ARE CLEARLY REQUIRED.

246 GRAPHICAL INPUT DEVICES

IRVING, G.W., HORINEK, J.J., WALSH, D.H., & CHAN, P.Y. ODA PILOT STUDY II: SELECTION OF AN INTERACTIVE GRAPHICS CONTROL DEVICE FOR CONTINUOUS SUBJECTIVE FUNCTIONS APPLICATIONS (REPORT NO. 215-2). SANTA MONICA, CALIFORNIA: INTEGRATED SCIENCES CORP., APRIL 1976.

DESCRIPTION:

THIS REPORT PRESENTS THE RESULTS OF A PILOT STUDY UNDERTAKEN TO EVALUATE THE PERFORMANCE OF THREE INTERACTIVE GRAPHICS CONTROL DEVICES -- LIGHTPEN, TRACK BALL, AND JOYSTICK -- FOR THE TYPES OF "DRAWING" TASKS REQUIRED TO DETERMINE CONTINUOUS SUBJECTIVE FUNCTIONS (CSF'S). THIS REPORT INCLUDES (1) A BRIEF REVIEW OF CSF'S IN THE CONTEXT OF COMPUTER-AIDED DECISION MAKING; (2) A DESCRIPTION OF THE TYPES OF DRAWING TASKS USED IN GENERATING CSF'S; AND (3) THE EXPERIMENTAL DESIGN, PROCEDURES, PERFORMANCE MEASURES, AND INTERPRETATION OF RESULTS. THE RESULTS OF THIS STUDY CONCLUDE THAT THE TRACK BALL IS THE BEST OVERALL CONTROL DEVICE FOR USE IN SUBSEQUENT CSF STUDIES. (A)

COMMENTS:

THIS IS A RATHER STRAIGHTFORWARD COMPARISON OF THREE INPUT DEVICES. THE DATA ARE, PERHAPS, REPORTED IN TOO MUCH DETAIL AND THE LACK OF SUMMARY DATA AND SUPPORTING STATISTICS SOMEWHAT OBSCURES THE RESULTS. IT IS APPARENT, HOWEVER, THAT THE TRACK BALL IS THE PREFERRED INPUT DEVICE, WITH RESPECT TO THE USER'S ABILITY TO DRAW STRAIGHT LINES AND CIRCLES. THESE RESULTS DO NOT WARRANT GENERALIZATION OF THIS FINDING TO OTHER TYPES OF GRAPHICAL INPUT TASKS.

247 RELATIONSHIP BETWEEN COMPUTER SYSTEMS AND CONSUMER IVERGARD, T.B.K. MAN-COMPUTER INTERACTION IN PUBLIC SYSTEMS. PAPER PRESENTED AT NATO ADVANCED STUDY INSTITUTE ON MAN-COMPUTER INTERACTION, MATI, GREECE, SEPTEMBER 1976 (REPRINTED BY ERGOLAB, STOCKHOLM, SWEDEN, AS REPORT NO. 1975:22).

DESCRIPTION:

THIS PAPER ARGUES THAT THE RELATIONSHIP BETWEEN CERTAIN CLASSES OF INFORMATION SYSTEMS AND THE CONSUMER (WHO MAY NOT BE THE DIRECT OPERATOR OF THE SYSTEM) SHOULD BE CONSIDERED IN THE DESIGN OF THOSE SYSTEMS. TWO EXAMPLES ARE DISCUSSED. THE FIRST IS A TELEPHONE INFORMATION SYSTEM USED TO PROCESS REQUESTS FOR CHANGES IN TELEPHONE SERVICE. ALTHOUGH THE CONSUMER IS NOT THE OPERATOR OF THIS SYSTEM, WHICH IS ACTUALLY OPERATED BY A TELEPHONE COMPANY EMPLOYEE, IT IS USED TO PROCESS, IN REAL TIME, REQUESTS MADE BY THE CONSUMER IN PERSON OR BY TELEPHONE. THE SYSTEM THEREFORE AFFECTS THE CONSUMER, AND THE CONSUMER'S NEEDS AND ATTITUDES AFFECT, IN TURN, THE SUCCESS WITH WHICH THE SYSTEM CAN BE EMPLOYED. THE ARTICLE BRIEFLY DISCUSSES AN ERGONOMIC ANALYSIS WHICH TOOK INTO ACCOUNT THE OPERATOR—CONSUMER INTERACTION, AS WELL AS THE OPERATOR—COMPUTER INTERACTION. THE SECOND EXAMPLE IS A COST—BENEFIT ANALYSIS OF AN AUTOMATED CHECKOUT SYSTEM FOR USE IN RETAIL SALES OUTLETS. IT IS POINTED OUT THAT THE SYSTEM MAY BENEFIT WHOLESALERS, RETAILERS, AND CASHIERS MORE THAN IT BENEFITS THE CONSUMER AND SOCIETY AS A WHOLE. IN FACT, THE NET IMPACT ON THE CONSUMER MAY BE NEGATIVE. SOME SPECIFIC ADVANTAGES AND DISADVANTAGES OF SUCH SYSTEMS ARE DISCUSSED FROM THE VIEWPOINT OF EACH OF THESE FOUR GROUPS OF PEOPLE.

THIS PAPER POINTS OUT A MUCH-IGNORED MIDDLE GROUND BETWEEN THE TRADITIONAL OPERATOR-COMPUTER INTERFACE QUESTIONS USUALLY DISCUSSED BY ERGONOMISTS AND THE BROAD SOCIAL IMPLICATIONS OF COMPUTERS, WHICH ARE NOT USUALLY CONSIDERED TO BE AN ERGONOMIC ISSUE. AS THIS PAPER SUGGESTS, THE WAY IN WHICH THE PUBLIC IS AFFECTED BY A SYSTEM MAY HAVE IMPLICATIONS FOR THE DESIGN OF THAT SYSTEM, AND FOR THE DEGREE OF SUCCESS IT CAN ACHIEVE. UNFORTURATELY, THE ONLY AREA RECEIVING DETAILED DISCUSSION HERE IS THE DESIGN OF A WORK STATION —— THE POSSIBLE EFFECT OF CONSUMER CONSIDERATIONS ON THE MORE BASIC SYSTEM DESIGN IS NOT TREATED. THIS IS, HOWEVER, A THOUGHT-PROVOKING ARTICLE, WHICH DESERVES READING BY THOSE INVOLVED IN THE DESIGN OF SYSTEMS WHICH INVOLVE

THE PUBLIC.

248 INFORMATION REPRESENTATION IN DISPLAYS

JACUB, R.J.K., EGETH, H.E., & BEVAN, W. THE FACE AS A DATA DISPLAY. HUMAN
FACTORS, 1976, 18, 189-200.
DESCRIPTION:

COMPUTER-GENERATED SCHEMATIC FACES HAVE BEEN PROPOSED AS A POTENTIALLY USEFUL MEDIUM FOR COMMUNICATING COMPLEX DATA. TWO EXPERIMENTS WERE PERFORMED TO EXAMINE FACES IN THIS REGARD. IN THE FIRST EXPERIMENT, SUBJECTS PERFORMED A CLUSTERING TASK IN A NINE-DIMENSIONAL EUCLIDEAN SPACE. SUBJECTS PERFORMED SIGNIFICANTLY AND SUBSTANTIALLY BETTER WHEN THE POINTS IN THE NINE-SPACE WERE REPRESENTED BY FACES THAN WHEN THEY WERE REPRESENTED IN EITHER OF TWO ALTERNATE WAYS. IN THE SECOND EXPERIMENT, SUBJECTS PERFORMED A PAIRED-ASSOCIATE LEARNING TASK WITH FACES AND WITH A VARIETY OF OTHER STIMULI OF THREE DIFFERENT DIMENSIONALITIES. WHILE FACES WERE FOUND TO RESULT IN GENERALLY SUPERIOR PERFORMANCE, A NUMBER OF OTHER INTERESTING EFFECTS WERE ALSO OBSERVED. (A)

COMMENTS:

THIS PAPER DESCRIBES AN INTERESTING AND NOVEL APPROACH TO STUDYING THE EFFECTS OF DISPLAY CONTENT ON INFORMATION ASSIMILATION. THE EXPERIMENTS REPORTED IN THIS PAPER ARE CLEARLY REPORTED AND APPEAR TO HAVE BEEN CAREFULLY CONTROLLED. SUBJECTS PERFORMED SIGNFICANTLY BETTER ON BOTH A SORTING TASK AND A PAIRED-ASSOCIATES TASK WHEN SCHEMATIC FACES WERE USED AS STIMULI RATHER THAN POLYGONS, DIGIT MATRICES, OR OTHER SCHEMATIC REPRESENTATIONS. THE PRINCIPAL REASON FOR THIS RESULT APPEARS TO BE THAT FACES ARE FAIRLY FAMILIAR AND SUBJECTS HAVE A WELL-DEVELOPED CONCEPTUAL STRUCTURE FOR CLARIFYING FACES. IN ADDITION, SUBJECTS WERE ABLE TO DESCRIBE A FACE WITH A SINGLE NAME WHILE OTHER STIMULI WERE MORE DIFFICULT TO DESCRIBE, THUS INCREASING TASK DIFFICULTY. THIS POINTS TO THE NEED TO PRESENT INFORMATION IN SUCH A MANNER THAT THE USER CAN EASILY INTEGRATE THIS INFORMATION WITH A WELL-DEVELOPED CONCEPTUAL STRUCTURE AND, THEREFORE, PROCESS AND INTEGRATE THIS INFORMATION MORE QUICKLY AND ACCURATELY. THE AUTHORS CONSIDER ONLY BRIEFLY THE APPLICATIONS OF THIS RESEARCH.

# 249 TERMINALS

JENNY, J.A. THE CRUCIAL ELEMENT IN EFFECTIVE COMPUTER UTILIZATION IS MAN-MACHINE INTERACTION. AUTOMATION, MAY 1973, 20(4), 72-76. DESCRIPTION:

THE INCREASING EASE OF IMPLEMENTING TIME SHARING SYSTEMS, THE AVAILABILITY OF A VARIETY OF TERMINAL TYPES, AND THE DESIRE FOR FAST RESPONSE HAVE RESULTED IN INCREASED INTEREST IN TERMINAL-BASED COMPUTER SYSTEMS. YET, THIS INTEREST HAS TOO OFTEN RESULTED IN SYSTEMS WHICH ARE HARD TO USE DUE TO THE BEWILDERING ACTIONS REQUIRED OF THE TERMINAL USER, AND THE UNDECIPHERABLE OUTPUT HE RECEIVES AS PUNISHMENT FOR NOT "FORMATTING" CORRECTLY. THIS EASE-OF-USE PROBLEM IS CAUSED BY THE CONTROLLING SOFTWARE, AS WELL AS THE TERMINAL, BUT THE APPROPRIATE CHOICE OF TERMINAL CAN SIGNIFICANTLY REDUCE THE SOFTWARE BURDEN BY PREVENTING TOO WIDE A VARIETY OF POSSIBLE OPERATOR MISTAKES.

COMPUTER DECENTRALIZATION AND THE USE OF INTER-CONNECTED SUBSYSTEMS MAKES IT EASY TO DEDICATE CENTRAL PROCESSORS TO SPECIFIC APPLICATION AREAS. TERMINAL I/O DEVICES SHOULD SIMILARLY BE CHOSEN FOR THEIR CAPABILITY TO MEET REQUIREMENTS OF A SPECIFIC APPLICATION. ALTHOUGH SOME HIGH-FUNCTION TERMINALS ARE FLEXIBLE ENOUGH TO MEET A WIDE VARIETY OF APPLICATIONS, A MORE SATISFACTORY SYSTEM WILL GENERALLY RESULT WHEN SEVERAL DIFFERENT TYPES OF LIMITED-CAPABILITY TERMINALS ARE USED. (A) SP, OR.

COMMENTS:

THIS IS A NON-TECHNICAL, EASY TO READ DISCUSSION THAT PRESENTS GUIDELINES FOR TERMINAL SELECTION. THE EMPHASIS IS ON UNDERSTANDING THE USER'S JOB FUNCTION AND RELATED VARIABLES AND SELECTING A TERMINAL TO BEST FIT THE PARTICULAR APPLICATION AREA. THE SECTION ON PSYCHOLOGICAL FACTORS, ALTHOUGH GENERALLY ACCURATE, IS VERY BRIEF AND THE AUTHOR FAILS TO CITE RESEARCH THAT WOULD SUPPORT HIS CLAIMS. NEVERTHELESS, THE IDEAS PRESENTED IN THIS PAPER MAY BE USEFUL IN THE PRELIMINARY STAGES OF TERMINAL EVALUATION AND SELECTION.

250 MAN-COMPUTER DIALOGUE

JOHNSON, C.I. PRINCIPLES OF INTERACTIVE SYSTEMS. IBM SYSTEMS JOURNAL, 1968, 7, 147-173.

DESCRIPTION:

EMPHASIZING PROGRAMMING ASPECTS, VARYING APPROACHES ARE CONSIDERED WITH RESPECT TO SYSTEM CONCEPTS AND PERIPHERAL GRAPHICS PROCESSORS, AS WELL AS COMPLEX DATA STRUCTURES, HIGH-LEVEL LANGUAGES, AND IMAGE-GENERATION TECHNIQUES. MANY OF THE PROBLEMS DISCUSSED ARE NOT UNIQUE TO GRAPHICS SYSTEMS BUT ARE COMMON TO INTERACTIVE SYSTEMS IN GENERAL.

THE REQUIREMENTS FOR A CONVERSATIONAL SYSTEM TO SUPPORT PROGRAMMERS AND

THE REQUIREMENTS FOR A CONVERSATIONAL SYSTEM TO SUPPORT PROGRAMMERS AND APPLICATION USERS ARE LISTED IN THE APPENDIX. AN EXTENSIVE BIBLIOGRAPHY HAS BEEN ADDED. (A, ABBREV.) 27P, 92R.

COMMENTS:

THIS PAPER PRESENTS A STATE-OF-THE-ART REVIEW OF INTERACTIVE GRAPHICS SYSTEMS UP TO 1968. ALTHOUGH THIS IS A FAIRLY COMPREHENSIVE REVIEW, IT IS SOMEWHAT DATED. FOR EXAMPLE, THE AUTHOR CITES THE NEED TO DEVELOP AND USE TIME-SHARED COMPUTER SYSTEMS, WHICH ARE CURRENTLY BECOMING FAIRLY STANDARD. THIS PAPER WOULD PRIMARILY BE RELEVANT TO ANYONE WISHING A HISTORICAL OVERVIEW OF EARLY DEVELOPMENTS IN INTERACTIVE GRAPHICS. IN ADDITION, THIS PAPER INCLUDES A FAIRLY EXTENSIVE BIBLIOGRAPHY THAT MAY BE USEFUL TO THOSE INTERESTED IN INTERACTIVE GRAPHICS.

251 TOUCH PANEL INPUT DEVICES

JOHNSON, E.A. TOUCH DISPLAYS: A PROGRAMMED MAN-MACHINE INTERFACE. ERGONOMICS, 1967, 10, 271-277.

DESCRIPTION:

A VERY LARGE NUMBER OF SO-CALLED AUTOMATIC DATA-PROCESSING SYSTEMS REQUIRE THE CO-OPERATION OF HUMAN OPERATORS TO ACHIEVE SATISFACTORY OPERATION. IN MANY OF THESE SYSTEMS, IT IS NECESSARY TO REDUCE OPERATOR REACTION TIME TO A MINIMUM, WHICH IN TURN DEMANDS AN ARRANGEMENT WHERE THE MAN-MACHINE COMMUNICATIONS ARE OPTIMIZED. THIS REQUIRES THAT THE METHODS OF PRESENTING INFORMATION TO, AND RECEIVING INSTRUCTIONS FROM, THE OPERATOR SHOULD BE RAPID AND EASY. (A) 7P, OR.

COMMENTS:

THIS PAPER PROVIDES A CLEAR DESCRIPTION OF AN EARLY TOUCH PANEL INPUT DEVICE. TECHNICAL DETAILS OF THE TOUCH PANEL ARE BRIEFLY CONSIDERED AND AN ILLUSTRATION OF ITS USE IN AN AIR TRAFFIC CONTROL TASK IS PRESENTED. ALTHOUGH THE TOUCH PANEL DESCRIBED IS RELATIVELY UNSOPHISTICATED (16 TOUCH POINTS) IT APPEARS TO BE ADEQUATE FOR THIS TASK. ALTHOUGH THE AUTHOR DOES NOT CONSIDER HUMAN FACTORS ISSUES IN ANY DETAIL OR PRESENT THE RESULTS OF EMPIRICAL EVALUATIONS, A TOUCH PANEL DOES RESULT IN FASTER AND SIMPLER INPUT IN THOSE CASES WHERE THE OPERATOR MUST SELECT FROM A PREDEFINED SET OF ALTERNATIVES. A MORE RECENT DISCUSSION OF TOUCH PANEL INPUT, FOR A MANAGEMENT INFORMATION SYSTEM, IS PRESENTED BY J.K. JOHNSON (1977).

252 DIALOGUE WITH TOUCH INPUT JOHNSON, J.K. TOUCHING DATA. DATAMATION, JANUARY 1977, 23(1), 70-72. DESCRIPTION:

THIS PAPER CONTENDS THAT THE USE OF COMPUTER-INITIATED DIALOGUE WITH TOUCH-PANEL INPUT CAN GO A LONG WAY TOWARD ENSURING ACCEPTANCE OF MANAGEMENT INFORMATION SYSTEMS BY MANAGER-USERS. THE PAPER POINTS OUT THAT THE USE OF KEYBOARDS REQUIRES SKILL, INTERPOSES AN OBTRUSIVE INTERFACE DEVICE BETWEEN USER AND SYSTEM, AND TENDS TO INVOLVE DIALOGUES WHICH REQUIRE THAT THE USER HAVE CONSIDERABLE KNOWLEDGE OF THE SYSTEM. WHILE THESE CONDITIONS MAY BE ACCEPTABLE TO MANY CLASSES OF USERS, THEY ARE OFTEN UNACCEPTABLE TO MANAGERS. THE PAPER DESCRIBES, BY WAY OF ILLUSTRATION, AN MIS DEVELOPED FOR RED OWL STORES. EXAMPLES ARE GIVEN OF THE DIALOGUE, A DISPLAY WITH TOUCH INPUT, AND THE PROCEDURE FOR DIALOGUE DEVELOPMENT.

COMMENTS:

THIS IS AN ABLE, NONTECHNICAL DISCUSSION OF THE USE OF COMPUTER-INITIATED DIALOGUE AND TOUCH-PANEL INPUT TO REDUCE THE INTIMIDATING PROPERTIES AND SPECIAL SKILL AND KNOWLEDGE REQUIREMENTS OF MANAGEMENT INFORMATION SYSTEMS, IN ORDER TO INCREASE THE USEABILITY AND ACCEPTANCE OF SUCH SYSTEMS BY THEIR MANAGER-USERS. IT IS LIKELY THAT THE USE OF SUCH TECHNIQUES CAN HELP CONSIDERABLY IN THIS AREA, BUT THEY ARE UNLIKELY TO BE A PANACEA. EASON (1976) HAS DISCUSSED A NUMBER OF MORE BASIC PROBLEMS WHICH MAKE THE DESIGN OF GOOD MANAGEMENT INFORMATION SYSTEMS VERY DIFFICULT. STILL, THE FIRST STEP IS TO MAKE THE SYSTEM APPROACHABLE FROM THE VIEWPOINT OF ITS PROSPECTIVE USERS. THIS PAPER SHOULD BE OF INTEREST TO MIS DESIGNERS, BUT MIGHT BENEFIT THOSE CONCERNED WITH OTHER CLASSES OF USERS WITH SIMILAR PROPERTIES (E.G., USERS OF MILITARY COMMAND AND CONTROL SYSTEMS).

253 COMPARISON OF CRT, TELETYPEWRITER AND MANUAL MODES FOR SCHEDULING
JONES, C.H., HUGHES, J.L., & ENGVOLD, K.J. A COMPARATIVE STUDY OF MANAGEMENT
DECISION-MAKING FROM COMPUTER-TERMINALS. AFIPS CONFERENCE PROCEEDINGS, 197C,
36, 599-605.
DESCRIPTION:

THIRTY-TWO PRODUCTION SCHEDULERS, IN TEAMS OF TWO, SOLVED A JOB-SHOP SCHEDULING PROBLEM USING MANUAL METHODS OR USING COMPUTER ALDS VIA EITHER A TELETYPEWRITER TERMINAL OR A CRT DISPLAY WITH LIGHT PEN. SUBJECTS WERE TO MAXIMIZE CALCULATED PROFIT. NO MEAN DIFFERENCES WERE OBSERVED ON PROFIT, BUT THE CRT GROUP HAD VERY LOW PROFIT VARIANCE, WHILE THE MANUAL GROUP'S PROFIT VARIANCE WAS VERY HIGH. COMPUTER-AIDED GROUPS HAD FEWER ERRORS AND JOB OMISSIONS. THE CRT GROUP HAD MANY RAPID ITERATIONS, THE TELETYPEWRITER GROUP FEWER, THE MANUAL GROUP VERY FEW. THE CRT WAS PREFERRED BY SUBJECTS TO THE TELETYPEWRITER; COMPUTER AIDS WERE PREFERRED TO THE MANUAL MODE.

7P, 13R.

COMMENTS:

UNFORTUNATELY, THE EXPERIMENTAL CONDITIONS USED HERE ARE NOT FULLY DESCRIBED. SEVERAL FACTORS ARE CLEARLY CONFOUNDED IN THE EXPERIMENT, BUT PROBABLY IN A REALISTIC WAY. THUS, SCHEDULING WITH THE CRT DISPLAY EMPLOYED A VERY GRAPHICAL DIALOGUE WITH A LIGHTPEN. BECAUSE THE SPECIFIC PROPERTIES OF THE MAN-COMPUTER DIALOGUES, OR OF THE MANUAL AIDS EMPLOYED, ARE CONFOUNDED WITH THE BASIC INTERFACE DEVICES USED, IT WOULD BE VERY HELPFUL TO HAVE A BETTER DESCRIPTION OF THOSE PROPERTIES. THE STUDY USED A SMALL SAMPLE (5 OR 6 TEAMS PER CONDITION). ALTHOUGH THE MEAN PERFORMANCE DIFFERENCE IS NOT STATISTICALLY SIGNIFICANT, AIDED GROUPS PERFORMED ABOUT 18 PERCENT BETTSR THAN THE UNAIDED GROUP. EVEN IF THIS DIFFERENCE WERE STATISTICALLY SIGNIFICANT, HOWEVER, IT MIGHT BE DIFFICULT TO INTERPRET, SINCE PERFORMANCE ON A COMMON PRELIMINARY SCHEDULING TASK SHOWED EVEN LARGER GROUP DIFFERENCES BEFORE THE SUNJECTS ENTERED THEIR EXPERIMENTAL CONDITIONS. THUS, THE ONLY CLEAR RESULT IS A GREAT REDUCTION IN PERFORMANCE VARIATION FOR THE CRT GROUP, AND A SMALLER, BUT STILL IMPORTANT REDUCTION FOR THE CRT GROUP, AND A SMALLER, BUT STILL IMPORTANT REDUCTION FOR THE TELETYPEWRITER GROUP. THIS IS AN INTERESTING STUDY WHICH WOULD BENEFIT FROM A SLIGHTLY MORE DETAILED DESCRIPTION AND A LARGER SAMPLE.

254 USER ATTITUDES AND MOTIVATION

JORDAN, N. MOTIVATIONAL PROBLEMS IN HUMAN-COMPUTER OPERATIONS. HUMAN FACTORS, 1962, 4, 171-175.

DESCRIPTION:

IN DESIGNING MACHINES AND MAN-MACHINE SYSTEMS, HUMAN FACTORS ENGINEERING HAS GENERALLY CONCENTRATED UPON SEEKING SOLUTIONS TO PHYSIOLOGICAL PROBLEMS TO ENABLE THE HUMAN OPERATOR TO FUNCTION EFFICIENTLY. IT HAS, HOWEVER, NEGLECTED THE PSYCHOLOGICAL PROBLEMS, PARTICULARLY THE PROBLEMS OF MOTIVATION. THIS WAS NOT TOO CRITICAL AS LONG AS MACHINES WERE "PRIMITIVE". WITH THE ADVENT OF AUTOMATION AND COMPLEX MAN-MACHINE SYSTEMS THIS NEGLECT MAY HAVE MOST UNDESIRABLE EFFECTS. AN ATTEMPT IS MADE TO IDENTIFY THE NECESSARY CONDITIONS WHICH MAKE A TASK, PER SE, MOTIVATING. EXAMPLES ARE CITED FROM SOME NEW SYSYEMS WHERE SOME OF THESE NECESSARY CONDITIONS ARE LACKING AND THE EFFECT OF THIS LACK UPON THE OPERATOR IS INDICATED. (A) SP, 3R.

COMMENTS:

THIS ARTICLE EXPRESSES A STRONG CONCERN FOR THE MOTIVATIONAL ASPECTS OF JOB DESIGN IN CONNECTION WITH THE USE OF INTERACTIVE COMPUTER SYSTEMS. SEVERAL EARLY SYSTEMS ARE CITED WHICH, IN THE AUTHOR'S OPINION, WERE DESIGNED IN A MANNER THAT WAS DEMOTIVATING TO THEIR SUPPORT PERSONNEL. THE AUTHOR SUGGESTS THAT A JOB MUST INVOLVE A DIFFICULT TASK, A POSSIBILITY OF POOR PERFORMANCE, IMMEDIATE FEEDBACK, AND REAL RESPONSIBILITY, IN ORDER TO BE MOTIVATING. THIS IS A TOPIC WHICH HAS NOT RECEIVED MUCH SUBSEQUENT ATTENTION IN THE AMERICAN HUMAN FACTORS LLTERATURE, ALTHOUGH IT IS ONE OF THE DOMINANT CONCERNS OF THE MODERN EUROPEAN LITERATURE AMD HAS RECEIVED SOME ATTENTION IN THE COMPUTER SCIENCE JOURNALS. THIS EARLY ARTICLE, LIKE MANY LATER ONES, EXPRESSES CONCERN, BUT PROVIDES FEW CONCRETE SUGGESTIONS FOR COPING WITH THIS POTENTIALLY DIFFICULT PROBLEM.

255 MAN-COMPUTER TASK ALLGCATION

JORDAN, N. ALLOCATION OF FUNCTIONS BETWEEN MAN AND MACHINES IN AUTOMATED SYSTEMS. JOURNAL OF APPLIED PSYCHOLOGY, 1963, 47, 161-165. DESCRIPTION:

WITH THE GROWING COMPLEXITY OF THE MAN-MACHINE SYSTEMS THE PROBLEM OF ALLOCATION BECOMES MORE CRITICAL. LITTLE PROGRESS HAS BEEN MADE TOWARDS ITS SOLUTION SINCE THE PUBLICATION OF FITTS' ARTICLE IN 1951 WHICH HAS DOMINATED THINKING IN THIS AREA. FITTS RECOMMENDED THAT MAN BE COMPARED TO MACHINES AND BE CHOSEN FOR THOSE FUNCTIONS WHICH HE DOES BETTER THAN MACHINES AND VICE VERSA. TO DO SO IS WRONG; WHEN WE CAN COMPARE A MAN TO A MACHINE, WE FIND THAT WE CAN ALSO BUILD A MACHINE FOR THE FUNCTION INVOLVED. HENCE, THE LACK OF PROGRESS. MEN AND MACHINES ARE COMPLEMENTARY, RATHER THAN COMPARABLE. ONCE THE PROBLEM IS SO REFORMULATED, NEW WAYS OF THINKING WHICH APPEAR TO BE PROMISING OPEN UP. (A)

SP, 6R. COMMENTS:

THIS IS AN INTERESTING PAPER THAT FOCUSES ON THE PHILOSOPHY UNDERLYING MAN-COMPUTER TASK ALLOCATION RATHER THAN ON PRESENTING SPECIFIC GUIDELINES. ALTHOUGH THIS PAPER IS SOMEWHAT DATED, IT IS INTERESTING TO NOTE THAT SOME OF THE CONCEPTS DESCRIBED ARE CURRENTLY CONSIDERED TO BE VERY IMPORTANT TOPICS IN COGNITIVE PSYCHOLOGY.

INTERACTIVE GRAHICS

JOYCE, J.D., & CIANCIOLO, M.J. REACTIVE DISPLAYS: IMPROVING MAN-MACHINE GRAPHICAL COMMUNICATION. AFIPS CONFERENCE PROCEEDINGS, 1967, 31, 713-721. DESCRIPTION:

THE ON-LINE GRAPHIC REPRESENTATION AND SOLUTION OF PROBLEMS IS OPENING THE DOOR TO NEW AND EXCITING COMPUTER APPLICATIONS. CONTINUOUS MAN-MACHINE INTERACTION VIA GRAPHIC CONSOLES MAKES FEASIBLE THE SOLUTION OF ENTIRELY NEW CLASSES OF PROBLEMS. THIS EXPANDING USE OF COMPUTER GRAPHICS IS REQUIRING IMPROVED TECHNIQUES OF MAN-MACHINE COMMUNICATION AND GRAPHIC DATA MANAGEMENT. (A)

THIS PAPER VIEWS A GRAPHICS SYSTEM AS THE INTERFACE BETWEEN APPLICATIONS PROGRAMMERS AND THE CONSOLE USER. THE TECHNIQUES AND TOOLS DESIGNED TO IMPLEMENT THIS INTERFACE ARE CONSIDERED. 92, 15R.

COMMENTS:

THIS PAPER DESCRIBES AN EARLY ATTEMPT AT THE DEVELOPMENT OF AN INTERACTIVE GRAPHICS SYSTEM. ALTHOUGH CURSORY ATTENTION IS GIVEN TO HUMAN FACTORS ASPECTS, PRIMARY ATTENTION IS GIVEN TO DATA BASE ORGANIZATION AND SOFTWARE AND HARDWARE FACTORS. MORE RECENT DEVELOPMENTS IN HARDWARE AND SOFTWARE TECHNOLOGY OUTDATE THESE DISCUSSIONS. THIS PAPER MAY, HOWEVER, BE OF INTEREST TO THOSE CONCERNED WITH EARLY DEVELOPMENTS IN INTERACTIVE GRAPHICS.

257 TIME-SHARING SYSTEMS

JUTILA, S.T., & BARAM, G. A USER-ORIENTED EVALUATION OF A TIME-SHARED COMPUTER SYSTEM. IEEE TRANSACTIONS ON SYSTEMS, MAN AND CYBERNETICS, 1971, SMC-1, 344-349. DESCRIPTION:

CRITERIA FOR THE EVALUATION OF COMPUTER SYSTEMS ARE TRADITIONALLY COMPUTER SCIENCE ORIENTED. THIS EXPLORATORY INVESTIGATION IS CONCERNED WITH EVALUATIONS OF USERS' SATISFACTION WITH A TIME-SHARED COMPUTER SYSTEM. FIRST PART OF THE INVESTIGATION IS AN EXPERIMENT INDICATING THAT THE TYPE OF PROGRAMMING LANGUAGE, I.E., BASIC VERSUS FORTRAN, IS THE RELEVANT SIGNIFICANT FACTOR IN DETERMINING THE LEARNING RATES FOR THE USE OF THE SYSTEM. THE SECOND PART OF THE INVESTIGATION IS DEVOTED TO THE STUDY OF AN ADDITIVE USERS' UTILITY FUNCTION. THE VARIABLES OF THIS FUNCTION ARE THE WAITING TIME IN THE QUEUE FOR A TIME-SHARED COMPUTER TERMINAL AND THE USERS' PROBLEM SOLVING TIME (USERS' TURN-AROUND TIME AT THE TERMINAL). IT WAS FOUND THAT USERS BECAME RAPIDLY DISSATISFIED IF THESE TIMES EXCEEDED 10-15 MINUTES. A PROBABILITY DENSITY FUNCTION FOR THE USERS' TURNAROUND TIME AT THE TERMINAL WAS OBTAINED IN THE SETTING OF AN INDUSTRIAL LABORATORY. IT TURNED OUT TO BE NEARLY EXPONENTIAL WITH A MEAN OF ABOUT 12 MIN. (A) 6P. 4DR.

COMMENTS:

THE AUTHORS LIST SEVERAL FACTORS THAT ARE POTENTIALLY RELEVANT IN USER-ORIENTED EVALUATIONS OF TIME-SHARED SYSTEMS AND THEN PROCEED TO DESCRIBE AN EXPERIMENT INVOLVING A SUBSET OF THESE FACTORS. EXCEPT FOR THE FACT THAT TASK DIFFERENCES WERE IGNORED, THIS EXPERIMENT APPEARS TO HAVE BEEN WELL DONE. THIS PAPER PRESENTS AN EARLY DEMONSTRATION OF THE FEASIBILITY AND USEFULNESS OF CONSIDERING USER VARIABLES IN THE DESIGN OF TIME-SHARING SYSTEMS.

258 DISCUSSION OF RESEARCH ON HUMAN FACTORS IN COMPUTER SYSTEMS KARLIN, J.E., & ALEXANDER, S.N. COMMUNICATION BETWEEN MAN AND MACHINE. PROCEEDINGS OF THE IRE, MAY 1962, 50(5), 1124-1128. DESCRIPTION:

THE INCLUSION OF COMPUTER-BASED ASSEMBLIES INTO MAN-MACHINE COMPLEXES HAS ENHANCED THE RELEVANCE OF CHARACTERISTICS OF THE HUMAN LINK IN THE SYSTEM. IN PARTICULAR, THE VIRTUES AND LIMITATIONS FOR TRANSMISSION OF INFORMATION AMONG THE PHYSICAL SUBSYSTEMS THROUGH A HUMAN CHANNEL IS AN IMPORTANT CONSIDERATION IN SYSTEMS DESIGN. THE CURRENT STATUS OF THE SUPPORTING RESEARCH FOR THIS AREA IS BRIEFLY SUMMARIZED. THE RELATED BUT MORE RECONDITE AREA COVERING COMMUNICATION BETWEEN MAN AND COMPUTER IS ALSO IMPORTANT TO THE EFFECTIVENESS OF MAN-MACHINE COMPLEXES. HOWEVER, SUPPORTING RESEARCH FOR THIS AREA IS MEAGER AND MOST OF IT IS CONTAINED IN ENGINEERING PSYCHOLOGY STUDIES PERTINENT TO THE NEEDS OF SPECIFIC SYSTEMS. RESEARCH FACILITIES MORE APPROPRIATE FOR THE EXPLORATORY NEEDS OF BOTH AREAS ARE BECOMING AVAILABLE AND THESE PRESAGE THE BROAD INTENSIVE PROGRAMS NEEDED TO PROVIDE RESEARCH GUIDANCE TO THE SYSTEMS DESIGN OF MAN-MACHINE COMPLEXES. (A)

5P, 23R.

COMMENTS:

THIS PAPER CONTAINS A BRIEF DISCUSSION OF HUMAN INFORMATION PROCESSING ABILITIES AS THEY APPLY TO MAN-MACHINE COMMUNICATION. THE PROBLEMS INVOLVED IN APPLYING BASIC RESEARCH RESULTS TO APPLIED DOMAINS ARE ALSO CONSIDERED. ALTHOUGH THIS PAPER IS SOMEWHAT DATED, IT DOES PROVIDE A HISTORICAL PERSPECTIVE OF RESEARCH AND THINKING ON MAN-COMPUTER COMMUNICATION AND IT SHOULD BE RELEVANT TO THOSE INTERESTED IN THIS TOPIC.

259 COLOR CODING

KARNER, C. PERCEIVED VERSUS ACTUAL VALUE OF COLOR-CODING. IN PROCEEDINGS, HUMAN FACTORS SOCIETY, 19TH ANNUAL MEETING. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1975, 227-231.
DESCRIPTION:

COLOR-CODING HAS BECOME A WIDELY-USED METHOD OF INFORMATION INPUT CODING. UNFORTUNATELY, LITTLE IS KNOWN REGARDING GENERAL STATEMENTS CONCERNING UNDER WHAT CONDITIONS COLOR-CODING WILL FACILITATE PERFORMANCE. FOR THIS REASON, A DECISION IS OFTEN MADE ON THE BASIS OF JUDGMENT IF EMPIRICAL DATA IS NOT AVAILABLE.

THE PRESENT STUDY IS DESIGNED TO EXAMINE PERFORMANCE IN A PARTICULAR SHORT-TERM MEMORY TASK AND TO ASSESS THE ACTUAL VALUE OF COLOR-CODING IN THE TASK. THIS ACTUAL VALUE IS THEN COMPARED TO THE PARTICIPANTS JUDGMENTS OF THE VALUE OF COLOR-CODING IN THAT TASK. THE TASK REQUIRED THE SUBJECT TO KEEP TRACK OF THE CURRENT STATE OF EACH OF SEVERAL VARIABLES. ONE GROUP USED A COLOR-CODING SYSTEM WHILE A SECOND GROUP DID NOT. THE RESULTS SHOWED PERFORMANCE TO BE SIGNIFICANTLY BETTER WITHOUT COLOR-CODING; HOWEVER, ALL SUBJECTS FROM EACH GROUP IN A POST-TEST INTERVIEW SAID THEY FELT THAT COLOR-CODING WOULD BE BENEFICIAL. THE IMPLICATION IS THAT HUMANS MAY HAVE RATHER POOR INSIGHT REGARDING THE FACILITATING EFFECTS OF COLOR-CODING.

COMMENTS:

IN MOST APPLICATIONS, COLOR CODING IMPLIES THAT A UNIQUE COLOR IS ASSOCIATED WITH A UNIQUE SYMBOL, OR ELEMENT OF SOME OTHER CODING DIMENSION. IN THIS EXPERIMENT, HOWEVER, COLORS WERE RANDOMLY PAIRED WITH SYMBOLS AND A SUBJECT'S TASK WAS TO RECALL THE LAST SYMBOL PAIRED WITH A GIVEN COLOR. OTHER POTENTIAL PROBLEMS WITH THIS STUDY INCLUDE THE FACT THAT COLORS AND SYMBOLS WERE PRESENTED SEPARATELY RATHER THAN SUPERIMPOSED AND ERROR RATES WERE VERY HIGH. IN ADDITION, THE ALTERNATIVE TO COLOR CODING THAT WAS USED WAS TO CODE BY COLOR NAMES. EVEN IF THIS ALTERNATIVE IS SUPERIOR TO COLOR CODING IN THE EXPERIMENTAL CONTEXT USED IN THIS PAPER, IT IS NOT APPLICABLE TO A LARGE NUMBER OF DISPLAYS. THE FACT THAT USER PREFERENCE RATINGS ARE NOT CONSISTENT WITH OBSERVED PERFORMANCE IS INTERESTING. IT SHOULD BE NOTED, HOWEVER, THAT USER PREFERENCE AND USER PERFORMANCE ARE NOT COMPLETELY INDEPENDENT AND THE TRADE-OFFS SHOULD BE CAREFULLY EXAMINED BEFORE MAKING SYSTEM DESIGN DECISIONS.

260 RECORDING OF OPERATOR-COMPUTER INTERACTION

KARUSH, A.D. THE CAPTURE AND REPLAY OF LIVE COMPUTER SYSTEM OPERATION. IN H. SACKMAN & R.L. CITRENBAUM (EDS.) ONLINE PLANNING: TOWARDS CREATIVE PROBLEM-SOLVING. ENGLEWOOD CLIFFS, NEW JERSEY: PRENTICE-HALL, 1972, 315-363. DESCRIPTION:

REGENERATIVE RECORDING IS A TECHNIQUE TO ALLOW COMPLETE DIGITAL COMPUTER SYSTEM PLAYBACK. A RECORDING COMPONENT RECORDS AN INITIAL SYSTEM STATE AND THEN TIME TAGS AND RECORDS ALL SUBSEQUENT INPUT TO THE SYSTEM. THE REGENERATIVE COMPONENT PLAYS BACK THE RECORDED INPUT IN ITS ORIGINAL SEQUENCE, STARTING FROM THE SAME INITIAL CONDITIONS AND FORCING THE SYSTEM TO REPEAT ITS ORIGINAL BEHAVIOR. THIS TECHNIQUE PROVIDES FOR THE CONTROLLED REPRODUCTION OF COMPUTER EVENTS AS THEY OCCURRED IN A LIVE COMPUTER RUN. REGENERATIVE RECORDING IS ONE OF THE TOOLS THAT SHOULD BE AVAILABLE TO

REGENERATIVE RECORDING IS ONE OF THE TOOLS THAT SHOULD BE AVAILABLE TO THE SYSTEM INVESTIGATOR. IT LIES BETWEEN SYSTEM OPERATION AND MEASUREMENT. CONVENTIONAL MEASUREMENT AND RECORDING TOOLS ARE ESSENTIALLY PARTIAL OR SELECTIVE RECORDING MECHANISMS. THEY CONTAIN NO CAPABILITY FOR RECONSTRUCTING AND RERUNNING THE ORIGINAL SYSTEM TEST. REGENERATIVE RECORDING PERMITS CAPTURE OF THE SYSTEM TEST AND THEN ITERATIVE PLAYBACK AND ANALYSIS USING THE SELECTIVE RECORDING AND MEASUREMENT TOOLS.

REGENERATIVE RECORDING HAS A NUMBER OF ADDITIONAL DIVERSE AND POWERFUL APPLICATIONS. THE APPLICATION OF REGENERATIVE RECORDING TO TIME-SHARING SYSTEMS IS A RECENT AND STILL EXPERIMENTAL DEVELOPMENT. BECAUSE ON-LINE PLANNING SYSTEMS WILL BE BUILT WITHIN A TIME-SHARING FRAMEWORK, AND BECAUSE THERE IS A REQUIREMENT TO STUDY THESE PLANNING SYSTEMS EXPERIMENTALLY AND SCIENTIFICALLY, THE EXISTENCE OF A REGENERATIVE RECORDING UTILITY BECOMES OF PARAMOUNT IMPORTANCE. (A) 49P, 11R.

## COMMENTS:

A REGENERATIVE RECORDING CAPABILITY COULD BE VERY USEFUL FOR SYSTEM TESTING, ANALYSIS, AND RESEARCH IN THAT IT PROVIDES A WELL CONTROLLED ENVIRONMENT IN WHICH EXPERIMENTAL MANIPULATIONS CAN BE MADE AND THE RESULTING EFFECTS OBSERVED. THE REPLAY CAPABILITY SEEMS VERY USEFUL FOR EXAMINING THE EFFECTS OF SYSTEM CHANGES ON COMPUTER SYSTEM PERFORMANCE, AS THE SAME DIALOGUE CAN BE REPLAYED BEFORE AND AFTER THE SYSTEM CHANGE. OBVIOUSLY, THIS WORKS ONLY IF THE BASIC FUNCTIONING OF THE SYSTEM IS UNALTERED. IN ANY EVENT, THE REPLAY CAPABILITY DOES NOT APPEAR TO ALLOW STUDY OF THE EFFECTS OF SYSTEM CHANGES ON THE USER. IT IS MORE SUITED, THEREFORE, FOR STUDY OF THE COMPUTER SIDE OF THE MAN-COMPUTER INTERFACE THAN THE HUMAN SIDE.

261 INTERACTIVE DIALOGUE CONTROL TECHNIQUE
KASIK, D.J. CONTROLLING USER INTERACTION. IN PROCEEDINGS OF THE THIRD ANNUAL
CONFERENCE ON COMPUTER GRAPHICS, INTERACTIVE TECHNIQUES AND IMAGE PROCESSING:
SIGGRAPH '76. COMPUTER GRAPHICS (ACM SIGGRAPH), 1976, 10(2), 109-115.

THIS ARTICLE DISCUSSES SEVERAL CAMDIDATE APPROACHES TO THE DEVELOPMENT OF GENERAL-PURPOSE INTERACTIVE DIALOGUE CONTROL SOFTWARE. CONTROL OF DIALOGUES VIA A SERIES OF IF STATEMENTS, FINITE-STATE-TRANSITION TABLES, AND KEYWORD TABLES WAS REJECTED BECAUSE OF VARIOUS LOGICAL AND PRACTICAL LIMITATIONS. A FOURTH APPROACH, THE "TRIPLY LINKED TREE," WAS SELECTED AND A WORKING SOFTWARE PACKAGE WAS IMPLEMENTED BASED ON THIS CONCEPT. THE PARTICULAR SOFTWARE DEVELOPED IS LIMITED TO USE WITH HIERARCHIC MENU-SELECTION DIALOGUES USING LIGHTPEN SELECTION. THE APPROACH IS CLAIMED TO BENEFIT THE USER BY ALLOWING PROMPTING, REQUESTS FOR COMMAND, DEFINITIONS, HISTORICAL DIALOGUE PLAYBACK, UP-AND-DOWN LEVEL-SKIPPING, AND CONSISTENT PROGRAM RESPONSES. IT IS ALSO SAID TO AID THE PROGRAMMER BY PROVIDING GENERAL-PURPOSE DIALOGUE CONTROL SUBROUTINES WHICH NEED ONLY BE CALLED, BY SIMPLIFYING DEBUGGING AND MAINTENANCE, AND, ESPECIALLY, BY ALLOWING EARLY STRUCTURING AND EXECUTION OF DIALOGUES BEFORE APPLICATION SYSTEM CODING BEGINS.

COMMENTS:

THE DIALOGUE CONTROL METHOD DESCRIBED HERE IS CLEARLY AN IMPROVEMENT OVER SIMPLE DIRECTED-GRAPH OR STATE-TRANSITION-DIAGRAM APPROACHES. THE APPROACH ALLOWS PROMPTING, ALTHOUGH NOTHING ABOUT THE TECHNIQUE RESTRICTS ITS USE TO COMPUTER-INITIATED DIALOGUES. THE ADDITIONAL LINKING PROVIDED IN THE DIALOGUE STRUCTURE ALSO ALLOWS LEVEL-SKIPPING, HISTORICAL DIALOGUE PLAYBACK, AND RETURNS TO HIGHER LEVELS OF THE DIALOGUE STRUCTURE. IT IS STRICTLY RESTRICTED TO PURELY HIERARCHIC DIALOGUE STRUCTURES, HOWEVER, PRECLUDING NETWORK STRUCTURES AND RECURSION. THE TECHNIQUE SEEMS ADEQUATE FOR MOST STRUCTURALLY SIMPLE COMMAND LANGUAGES, AND IS A USEFUL CONTRIBUTION. BECAUSE THE CHOICE OF DIALOGUE CONTROL TECHNIQUE HAS SIGNIFICANT FUNCTIONAL IMPLICATIONS FOR THE USER, THIS ARTICLE SHOULD INTEREST THOSE CONCERNED WITH THE DESIGN OF INTERACTIVE DIALOGUES, AS WELL AS THOSE CONCERNED WITH THEIR IMPLEMENTATION.

262 ANNUAL REVIEW ARTICLE ON INFORMATION SYSTEMS
KATTER, R.V. DESIGN AND EVALUATION OF INFORMATION SYSTEMS. IN C.A. CUADRA
& A.W. LUKE (EDS.), ANNUAL REVIEW OF INFORMATION SCIENCE AND TECHNOLOGY
(VOL. 1). CHICAGO, ILLINOIS: ENCYCLOPEDIA BRITANNICA, 1969, 31-70.
DESCRIPTION:

IN CORRESPONDING CHAPTERS OF EARLIER VOLUMES OF THIS REVIEW MAY BE DISCERNED A TREND TOWARD PROGRESSIVE BROADENING OF CONTENT COVERAGE. THE INITIAL EMPHASIS WAS ON DESIGN AND EVALUATION CONCEPTS AND ON TECHNIQUES THAT WERE RATHER CLOSELY—AND NARROWLY—CONNECTED WITH INFORMATION STORAGE AND RETRIEVAL SYSTEMS. IT IS BECOMING INCREASINGLY CLEAR, HOWEVER, THAT THERE ARE MANY ACTIVITIES AND IDEAS OUTSIDE OF THIS CONTEXT THAT HAVE, OR CAN HAVE, A VERY IMPORTANT BEARING ON THE WORK OF SYSTEMS ANALYSTS, DESIGNERS, AND EVALUATORS WORKING ON LIBRARY AND DOCUMENTATION SYSTEMS. THIS CHAPTER ATTEMPTS TO CONTINUE ENLARGING OUR PERCEPTION OF THE RANGE OF REPORTED ACTIVITIES THAT CAN HELP TO IMPROVE THE KINDS OF SYSTEMS IN WHICH OUR READERS ARE CHIEFLY INTERESTED. (A)

COMMENTS:

LIKE ALL CHAPTERS IN THE "ANNUAL REVIEW OF INFORMATION SCIENCE AND TECHNOLOGY," THIS IS A VERY THOROUGH REVIEW OF THE LITERATURE FOR A SIMGLE YEAR IN A LIMITED AREA OF STUDY. AN INTERESTING CONCEPT EXPRESSED BY THE AUTHOR IS THAT DESIGN SHOULD BE VIEWED AS A REDEVELOPMENT, RATHER THAN A DEVELOPMENT ACTIVITY. THAT IS, DESIGN IS RARELY CONCERNED WITH A TOTALLY NEW SYSTEM AND IS FREQUENTLY CONCERNED WITH THE REPLACEMENT OR MODIFICATION OF AN EXISTING SYSTEM. TECHNIQUES FOR AIDING THIS REDEVELOPMENT PROCESS AND FOR EVALUATING THE EFFECTIVENESS OF INFORMATION RETRIEVAL SYSTEMS ARE DISCUSSED. THIS IS, OF COURSE, NOT AN UP-TO-DATE REVIEW OF INFORMATION SYSTEMS, BUT IT DOES CONTAIN A LARGE NUMBER OF REFERENCES AND PROVIDES A GOOD HISTORICAL PERSPECTIVE.

263 OPTICAL RECOGNITION OF HANDPRINTED NUMERIC CHARACTERS
KEGEL, A.G., GILES, J.K., & RUDER, A.H. OBSERVATIONS ON SELECTED APPLICATION
OF OPTICAL CHARACTER READERS FOR COMSTRAINED, NUMERIC HANDPRINT. IN
PROCEEDINGS, IEEE INTERNATIONAL CONFERENCE ON CYBERNETICS AND SOCIETY, NOVEMBER
1976. NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., 1976,
471-475.
DESCRIPTION:

A SURVEY WAS MADE OF OCR USERS WHO READ NUMERIC HANDPRINT (NHP) FROM FORMS WRITTEN BY THE GENERAL PUBLIC (UNCONTROLLED ENVIRONMENT). AN EXPERIMENT WAS ALSO DONE ON NHP REJECT/SUBSTITUTION RATES AND THE TYPES OF ERRORS WHICH COULD BE EXPECTED FROM WRITERS IN AN UNCONTROLLED POPULATION. FOR THIS EXPERIMENT AND THE USERS SURVEYED, OCR DIGIT REJECT RATES VARIED FROM 1 TO 7.2% WHILE DIGIT SUBSTITUTION RATES VARIED FROM 0.7 TO 1.8%, OVERALL. (A) 5P.4P.

COMMENTS:

BOTH THE SURVEY AND EXPERIMENT REPORTED IN THIS PAPER ARE PRESENTED INFORMALLY. THE EXPERIMENT INVOLVED ANALYSIS OF ACTUAL HANDWRITTEN FORMS USED BY THE POSTAL SERVICE. IT IS INTERESTING TO NOTE THE CLAIM THAT POSTAL ZIP CODES ARE PROCESSED SLIGHTLY MORE ACCURATELY BY AN OPTICAL CHARACTER READER THAN BY STANDARD MANUAL PROCEDURES. FOR TASKS IN WHICH THIS LEVEL OF ACCURACY IS ADEQUATE, OPTICAL RECOGNITION OF NUMERIC HANDWRINT WOULD APPEAR TECHNICALLY FEASIBLE. WHETHER THE USE OF SUCH AN INPUT TECHNIQUE IS DESIRABLE DEPENDS ON A VARIETY OF CONSIDERATIONS NOT DISCUSSED IN THIS PAPER, WHICH IS CONCERNED WITH THE RECOGNITION OF INFORMATION WHICH NECESSARILY ARRIVES IN HANDWRITTEN FORM. THE ERROR RATES REPORTED HERE MAY PROVIDE USEFUL INFORMATION FOR OTHER APPLICATIONS, TOO.

264 INTERPERSONAL DIALOGUE USING LIMITED VOCABULARY
KELLY, M.J. LIMITED VOCABULARY NATURAL LANGUAGE DIALOGUE. IN PROCEEDINGS,
HUMAN FACTORS SOCIETY, 19TH ANNUAL MEETING. SANTA MONICA, CALIFORNIA: HUMAN
FACTORS SOCIETY, 1975, 296-300.
DESCRIPTION:

SUBJECTS COOPERATIVELY SOLVED CREDIBLE, REAL-WORLD PROBLEMS WHILE COMMUNICATING THROUGH A COMPUTER CONTROLLED TELETYPE SYSTEM AND USING THREE DIFFERENT SIZES OF AVAILABLE VOCABULARY IN A SIMULATION OF A LIMITED VOCABULARY NATURAL LANGUAGE COMPUTER SYSTEM. ALTHOUGH SUBJECTS SOMETIMES EXHIBITED FRUSTRATION WITH THE SMALL VOCABULARIES, ANALYSES OF 21 DEPENDENT MEASURES INDICATED THAT THEY WERE ABLE TO INTERACT AND SOLVE THE PROBLEMS ABOUT AS SUCCESSFULLY AS DID THEIR COUNTERPARTS WHO COMPLETED THE SAME PROBLEMS WITH NO VOCABULARY RESTRICTIONS. THE RESULTS INDICATE THAT, AT LEAST FOR THE KINDS OF PROBLEMS TESTED HERE, IT SHOULD BE POSSIBLE TO DEVELOP A VOCABULARY OF LIMITED SIZE WHICH IS STILL EFFICIENT TO USE IN THE TYPE OF INTERACTIVE COMMUNICATION THAT MIGHT CHARACTERIZE NATURAL LANGUAGE COMPUTER SYSTEMS OF THE FUTURE. (A) 5P, 2R.

COMMENTS:

THIS IS A CONDENSED DESCRIPTION OF THE RESEARCH PREVIOUSLY DESCRIBED BY M.J. KELLY IN STUDIES IN INTERACTIVE COMMUNICATION: LIMITED VOCABULARY NATURAL LANGUAGE DIALOGUE (TECHNICAL REPORT NO. 3). BALTIMORE, MARYLAND: THE JOHNS HOPKINS UNIVERSITY, DECEMBER 1975. (AD A019198)

265 INTERPERSONAL DIALOGUE WITH RESTRICTED VOCABULARY
KELLY, M.J. STUDIES IN INTERACTIVE COMMUNICATION: LIMITED VOCABULARY NATURAL
LANGUAGE DIALOGUE (TECHNICAL REPORT NO. 3). BALTIMORE, MARYLAND: THE JOHNS
HOPKINS UNIVERSITY, DECEMBER 1975. (NTIS NO. AD A019198)
DESCRIPTION:

THE COMPLEXITY AND COSTS OF INTERACTIVE, NATURAL-LANGUAGE COMPUTER SYSTEMS COULD BE REDUCED IF THE MAN-COMPUTER COMMUNICATION USED ONLY A LIMITED SUBSET OF THE ENGLISH LANGUAGE. THE PURPOSE OF THIS STUDY WAS TO TEST THE HYPOTHESIS THAT PEOPLE, ALTHOUGH ACCUSTOMED TO UNRESTRICTED USE OF THE LANGUAGE, CAN EFFICIENTLY INTERACT USING A CAREFULLY CHOSEN SUBSET OF A FEW HUNDRED WORDS.

TWO-PERSON TEAMS COMMUNICATED THROUGH A COMPUTER-CONTROLLED TELETYPEWRITER SYSTEM TO COOPERATIVELY SOLVE REAL-WORLD PROBLEMS. THEY WERE PERMITTED TO USE ONLY WORDS ON PREDETERMINED LISTS OF 300 WORDS, OF 500 WORDS, OR AS A CONTROL CONDITION, WITH NO VOCABULARY RESTRICTIONS. THE TEAMS SOLVED A DIFERENT PROBLEM ON EACH OF THREE SUCCESSIVE DAYS. DEPENDENT MEASURES WERE TAKEN ON FOUR CLASSES OF VARIABLES: (1) TIME TO SOLVE THE PROBLEM, (2) SEVERAL MEASURES OF OVERT BEHAVIOR, (3) SEVERAL MEASURES OF VERBAL OUTPUT, AND (4) MEASURES OF ERRORS MADE BY SUBJECTS USING THE TWO RESTRICTED VOCABULARIES.

THERE WERE NUMEROUS SIGNIFICANT EFFECTS OF THE PROBLEMS, THE JOB ROLES OF SUBJECTS WITHIN THE TEAM, AND THE PROBLEM X JOB ROLE INTERACTION. HOWEVER, THE MORE INTERESTING MAIN EFFECT OF VOCABULARY SIZE WAS SIGNIFICANT FOR ONLY THREE OF THE 21 DEPENDENT MEASURES. FURTHERMORE, ONLY FOUR OF THE 105 INTERACTIONS INVOLVING VOCABULARY SIZE WERE STATISTICALLY SIGNIFICANT. THERE WAS LITTLE EVIDENCE OF SYSTEMATIC CHANGE ACROSS THE THREE DAYS OF TESTING THAT COULD BE ATTRIBUTED TO LEARNING--OF 84 MAIN EFFECTS AND INTERACTIONS INVOLVING DAYS, FIVE REACHED STATISTICAL SIGNIFICANCE.

THIS STUDY PRESENTS STRONG EVIDENCE OF THE ADAPTABILITY OF THE HUMAN

THIS STUDY PRESENTS STRONG EVIDENCE OF THE ADAPTABILITY OF THE HUMAN COMMUNICATOR. ALTHOUGH SOMETIMES EXHIBITING FRUSTRATION WITH THE SMALL VOCABULARIES, THE SUBJECTS WERE, NONETHELESS, ABLE TO SOLVE THEIR PROBLEMS ABOUT AS SUCCESSFULLY AS DID THEIR COUNTERPARTS IN THE UNLIMITED VOCABULARY CONDITION. THE RESULTS INDICATE THAT, AT LEAST FOR THE PROBLEMS TESTED HERE, IT IS POSSIBLE TO DEVELOP A RESTRICTED VOCABULARY THAT IS STILL EFFECTIVE FOR INTERACTIVE COMMUNICATION. (A) 77P, 91R.

## COMMENTS:

THE EXPERIMENT REPORTED IN THIS PAPER APPEARS TO HAVE BEEN CAREFULLY CONTROLLED AND REPRESENTS AN EFFECTIVE METHOD FOR STUDYING HUMAN COMMUNICATION. THIS EXPERIMENT IS PART OF A SERIES OF SIMILAR EXPERIMENTS CONDUCTED BY A. CHAPANIS AND HIS COLLEAGUES AT JOHNS HOPKINS UNIVERSITY. THE CURRENT PAPER, LIKE OTHERS IN THIS SERIES, DOES NOT FULLY ANALYZE THE RESULTS. SPECIFICALLY, SIGNIFICANT DIFFERENCES WERE FOUND BETWEEN THE PROBLEMS USED IN THIS STUDY. THESE PROBLEMS DIFFER IN THAT SOME REQUIRE THE COMMUNICATION OF DECLARATIVE INFORMATION AND OTHERS INVOLVE PROCEDURAL INFORMATION. SINCE A. COLLINS, E.H. WARNOCK, AND J.J. PASSAFIUNE (1974) OBSERVED THAT DIFFERENT STRATEGIES ARE USED TO TEACH THESE TYPES OF INFORMATION, IT SEEMS REASONABLE TO EXPECT THAT COMMUNICATION PATTERNS COULD ALSO BE AFFECTED BY THE SPECIFIC TASK. THIS IS AN INTERESTING AND IMPORTANT QUESTION THAT IS NOT FULLY EXPLORED IN THIS PAPER. IN ADDITION, THE LACK OF SIGNIFICANT EFFECTS DUE TO VOCABULARY SIZE MAY BE DUE TO THE FACT THAT THE RESTRICTED VOCABULARIES CONTAINED THE SAME NUMBER OF PROBLEM SPECIFIC WORDS AND THESE WORDS WERE NECESSARY AND SUFFICIENT FOR EFFECTIVE COMMUNICATION. IT SHOULD BE NOTED THAT THE STUDY ADDRESSES THE ABILITY OF SUBJECTS TO OPERATE WITH VOCABULARY LIMITATIONS, BUT DOES IMPOSE RESTRICTIONS ON SYNTAX, SUCH AS MIGHT BE REQUIRED FOR AUTOMATED PARSING OF SPOKEN INPUT.

266 INTERPERSONAL DIALOGUE WITH LIMITED VOCABULARY
KELLY, M.J., & CHAPANIS, A. LIMITED VOCABULARY NATURAL LANGUAGE DIALOGUE.
INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1977, 9, 479-501.
DESCRIPTION:

TWO-PERSON TEAMS OF SUBJECTS WORKED AT REALISTIC PROBLEM-SOLVING TASKS BY COMMUNICATING THROUGH A TELETYPEWRITER SYSTEM. ONE THIRD OF THE TEAMS HAD TO LIMIT THEIR VOCABULARY TO WORDS ON LISTS OF 300 WORDS, ONE-THIRD WERE REQUIRED TO USE WORDS ON LISTS OF 500 WORDS, AND ONE THIRD OF THE TEAMS WORKED WITH NO VOCABULARY RESTRICTIONS. EACH TEAM SOLVED A DIFFERENT PROBLEM ON EACH OF THREE SUCCESSIVE DAYS. DEPENDENT MEASURES WERE TAKEN ON FOUR CLASSES OF VARIABLES: (1) TIME TO SOLVE THE PROBLEM, (2) MEASURES OF OVERT BEHAVIOR, (3) MEASURES OF VERBAL OUTPUT, AND (4) ERRORS MADE BY SUBJECTS WHO USED THE RESTRICTED VOCABULARIES. THE MAIN FINDING OF THE EXPERIMENT WAS THAT SUBJECTS WHO WORKED WITH THE RESTRICTED VOCABULARIES INTERACTED AND SOLVED PROBLEMS AS SUCCESSFULLY AS THEIR COUNTERPARTS WHO WORKED WITH NO VOCABULARY RESTRICTIONS. THE RESULTS INDICATE THAT, AT LEAST FOR THE KINDS OF PROBLEMS TESTED HERE, IT IS POSSILE TO DEVELOP VOCABULARIES OF LIMITED SIZE THAT CAN BE USED EFFECTIVELY IN MAN-COMPUTER COMMUNICATIONS. (A)

COMMENTS:

THIS EXPERIMENT WAS PREVIOUSLY REPORTED IN M.J. KELLY (1975). WITH THE EXCEPTION OF THE INTRODUCTORY SECTION, THIS PAPER DIFFERS VERY LITTLE FROM THE FORMER, ALTHOUGH THE EARLIER WERSION DOES CONTAIN MORE REFERENCES.

267 GENERAL DISCUSSION OF MAN-COMPUTER INTERACTION
KEMENY, J.G. MAN AND THE COMPUTER. NEW YORK: CHARLES SCRIBNER'S SONS, 1972.
DESCRIPTION:

THIS BOOK PRESENTS A PERSONALIZED VIEW OF THE HISTORY OF MODERN COMPUTERS FROM 1946 TO 1971, EVALUATES THE CURRENT STATE OF THE ART AND VARIOUS APPLICATION OF COMPUTERS AND MAKES PREDICTIONS FOR THE STATE OF THE ART AND APPLICATIONS. A CENTRAL THEME IS THAT THE ADVENT OF MAN-COMPUTER INTERACTION WAS, NEXT TO THE DEVELOPMENT OF GENERAL-PURPOSE, HIGH-SPEED COMPUTERS, THE MOST SIGNIFICANT EVENT AND THAT THE FUTURE SIGNIFICANCE OF COMPUTERS LIES IN THE TEAMWORK BETWEEN HUMAN AND COMPUTER. 160P, 8R.

COMMENTS:

THIS BOOK IS BOTH ENTERTAINING AND INFORMATIVE. ALTHOUGH WRITTEN PRIMARILY FOR THE LAYMAN, THIS BOOK SHOULD ALSO BE OF INTEREST TO THE COMPUTER PROFESSIONAL. THE AUTHOR'S PROJECTIONS FOR FUTURE USES OF COMPUTERS APPEAR TO BE BOTH DESIRABLE AND ATTAINABLE. IT SHOULD BE REMEMBERED, HOWEVER, THAT THIS IS A PERSONALIZED VIEW RATHER THAN A SCHOLARLY TREATISE.

268 MAN-COMPUTER DIALOGUE

KENNEDY, T.C.S. THE DESIGN OF INTERACTIVE PROCEDURES FOR MAN-MACHINE COMMUNICATION. INTERNATIONAL JOURNAL OF THE MAN-MACHINE STUDIES, 1974, 6, 309-334.

DESCRIPTION:

THIS PAPER ANALYZES EXPERIENCE IN THE DESIGN OF EFFECTIVE INTERACTIVE COMMUNICATION PROCEDURES FOR COMPUTER SYSTEMS IN THE LIGHT OF ESTABLISHED RESEARCH ON HUMAN VERBAL SKILLS. THE PROCESS OF NORMAL COMMUNICATION BETWEEN INDIVIDUALS IS EXAMINED FOR PRINCIPLES WHICH MAY BE USEFULLY APPLIED TO THE DESIGN OF A MAN-MACHINE COMMUNICATION LANGUAGE. THE STRESSES IMPOSED BY SOCIAL FACTORS AND TIME/COST CONSTRAINTS ARE OFTEN INADEQUATELY COMPREHENDED BY SYSTEM DESIGNERS WITH THE RESULT THAT SYSTEMS DO NOT OPERATE AS EFFECTIVELY AS PREDICTED ON TECHNICAL GROUNDS. PRACTICAL EXPERIENCE IN THE DESIGN OF DATA ENTRY PROCEDURES IS EXAMINED AND IT IS SUGGESTED THAT THE SYSTEM, AS PERCEIVED BY THE USER, SHOULD BE MADE VERY SIMPLE AND NATURAL IN ITS STRUCTURE, EVEN THOUGH THIS MAY INVOLVE EXTENSIVE PROGRAMMING TO MATCH EFFICIENT INTERNAL DATA STRUCTURES TO THE REQUIRED EXTERNAL MODEL. FINALLY, A SET OF GROUND RULES FOR THE DESIGN OF A "WELL-BEHAVED" SYSTEM IS PROPOSED. (A) 26P, 22R.

COMMENTS:

THIS PAPER CONTAINS SEVERAL INTERESTING CONCLUSIONS ABOUT RELEVANT FACTORS FOR THE DESIGN OF INTERACTIVE DIALOGUES. THE PROPOSED GUIDELINES, WHICH ARE DESCRIPTIVE RATHER THAN PRESCRIPTIVE, WOULD BE OF INTEREST TO THOSE WITH A BACKGROUND IN HUMAN FACTORS BUT PROBABLY NOT BE RELEVANT TO DESIGNERS WISHING MORE PRESCRIPTIVE GUIDELINES. ALTHOUGH SOME OF THESE GUIDELINES ARE QUITE REASONABLE, THEY ARE VERY GENERAL AND ARE ILLUSTRATED ONLY BY EXAMPLE AND ANTECDOTE. A MORE RIGOROUS ATTEMPT TO VALIDATE THESE GUIDELINES WOULD PRODUCE A MORE CONVINCING ARGUMENT. THIS PAPER DOES PROVIDE AN EASILY READ INTRODUCTION TO SOME OF THE FACTORS THAT AFFECT THE QUALITY OF INTERACTIVE DIALOGUES.

269 EMBEDDED TRAINING IN SYSTEM FOR NAIVE USERS
KENNEDY, T.C.S. SOME BEHAVIOURAL FACTORS AFFECTING THE TRAINING OF NAIVE
USERS OF AN INTERACTIVE COMPUTER SYSTEM. INTERNATIONAL JOURNAL OF
MAN-MACHINE STUDIES, 1975, 7, 817-834.
DESCRIPTION:

THIS PAPER DESCRIBES THE DESIGN CONSIDERATIONS UNDERLYING THE DEVELOPMENT OF A SELF-CONTAINED COMPUTER SYSTEM WHICH IS TO FORM THE BASIS OF A MEDICAL INFORMATION SYSTEM AT SOUTHEND HOSPITAL. A DETAILED TRIAL HAS BEEN CONDUCTED TO EXAMINE THE PROBLEMS IN TRAINING NAIVE COMPUTER USERS IN THE USE OF SUCH A SYSTEM. THE TRIAL INVOLVED A LARGE SAMPLE OF CLERICAL AND SECRETARIAL STAFF AND PROVIDED 50 HOURS OF OBSERVATION AND MEASUREMENT OF MAN-MACHINE INTERACTION. ANALYSIS OF TEST RESULTS HAS REQUIRED THE DEVELOPMENT OF NEW MEASURES OF PERFORMANCE FOR RECORDING BEHAVIORAL VARIABLES, CONCEPTUALIZATION OF THE SYSTEM, AND LEVEL OF ABILITY.

VARIABLES, CONCEPTUALIZATION OF THE SYSTEM, AND LEVEL OF ABILITY.

IT IS SHOWN THAT IT IS POSSIBLE, WITH A SELF-TEACHING COMPUTER SYSTEM, TO TRAIN "COMPUTER-NAIVE" CLERICAL STAFF TO A HIGH DEGREE OF COMPETENCE IN A VERY SMALL NUMBER OF SHORT TRAINING SESSIONS. BEHAVIORAL PATTERNS ARE EXAMINED WITH REGARD TO THEIR INFLUENCE ON THE DESIGN OF COMMAND STRUCTURES.

18P, 12R.

WHEN AN INTERACTIVE CORPUTER SYSTEM IS INTENDED FOR USE PRIMARILY BY COMPUTER-NAIVE PERSONNEL, AN IMPORTANT DESIGN CONSIDERATION IS WHETHER OR NOT SUCH PERSONNEL CAN EFFECTIVELY USE AND MAINTAIN SUCH A SYSTEM. THIS PAPER DESCRIBES AN EXPERIMENT INTENDED TO EVALUATE SUCH A SYSTEM. THIS EXPERIMENT, HOWEVER, WAS NOT PROPERLY DESIGNED AND SEVERAL PROCEDURAL PROBLEMS MAKE IT DIFFICULT TO DRAW CONCLUSIONS ABOUT THE EFFECTIVENESS OF THE SYSTEM DISCUSSED. FOR EXAMPLE, DIFFERENT SUBJECTS WERE GIVEN DIFFERENT NUMBERS OF LEARNING TRIALS AND TRIALS WERE OF VARIABLE LENGTH. AS A RESULT OF THESE, AND OTHER, FACTORS, NO STATISTICAL ANALYSIS CAN BE APPLIED. THIS PAPER DOES, HOWEVER, INDICATE THE USEFULNESS OF DETERMINING DESIRED SYSTEM MODIFICATIONS ON THE BASIS OF THE RESULTS OF INTERACTIONS BETWEEN A PROPOSED SYSTEM AND ITS POTENTIAL USERS.

270 CONSOLE DESIGN FOR PROCESS CONTROL

KERN, J.L. THE COMPUTER-OPERATOR INTERFACE. CONTROL ENGINEERING, SEPTEMBER 1966, 13(9), 114-118.

DESCRIPTION:

STANDARDIZATION OF COMPUTER CONTROL CONSOLES IS NOT A FORESEABLE DEVELOPMENT. PERHAPS MORE THAN ANY OTHER PART OF THE SYSTEM, THE IDEAL CONSOLE ARRANGEMENT DEPENDS UPON THE PARTICULAR PROCESS AND PLANT CONCERNED. BUT IT IS ALSO A FUNCTION OF OPERATOR PREFERENCE, EXPERIENCE, AND MANY OTHER NOT-SO-TANGIBLE FACTORS. EACH APPLICATION SHOULD BE CAREFULLY CONSIDERED FROM TWO POINTS OF VIEW: HOW THE OPERATOR COMMUNICATES WITH THE COMPUTER IN NORMAL OPERATION, AND HOW HE TAKES OVER CONTROL OF THE PLANT WHEN THE COMPUTER IS DOWN. (A) 5P, OR.

COMMENTS:

THIS PAPER FOCUSES ON OPERATOR CONSOLE DESIGN IN A PROCESS CONTROL ENVIRONMENT. THE AUTHOR BRIEFLY REVIEWS VARIOUS TASK-SPECIFIC PROPERTIES OF DIFFERENT TASKS AND RELATES THESE PROPERTIES TO DESIRABLE CONSOLE FEATURES. THE EMPHASIS IS ON DEFINING HARDWARE AND SOFTWARE REQUIREMENTS FOR CONSOLES DESIGNED FOR A SPECIFIC TASK AND NO ATTENTION IS GIVEN TO HUMAN FACTORS ISSUES IN THE OPERATOR-CONSOLE INTERFACE.

271 REQUIREMENTS ANALYSIS FOR MANAGEMENT INFORMATION SYSTEMS
KING, W.R., & CLELAND, D.I. THE DESIGN OF MANAGEMENT INFORMATION SYSTEMS: AN
INFORMATION ANALYSIS APPROACH. MANAGEMENT SCIENCE, 1975, 22, 286-297.
DESCRIPTION:

THIS PAPER DESCRIBES A METHODOLOGY FOR MANAGEMENT INFORMATION SYSTEMS DESIGN WHICH EMPLOYS A FORMALIZED FRAMEWORK FOR SIGNIFICANTLY INVOLVING MANAGER-USERS IN THE DESIGN PROCESS. THE PROCESS SEEMS TO DEVELOP A SYSTEM DESIGN ON THE BASIS OF A CRITERION WHICH CONSIDERS BOTH TECHNICAL COST-BENEFIT CONSIDERATIONS AND THE MANAGER'S PERCEPTION OF THE POTENTIAL UTILITY OF THE SYSTEM. A KEY ELEMENT OF THE METHODOLOGY IS THE DEVELOPMENT OF DESCRIPTIVE AND NORMATIVE SYSTEM MODELS WHICH ARE BASED ON THE CONCEPT OF A "LINEAR RESPONSIBILITY CHART." THESE MODELS SERVE AS THE BASIS FOR THE NEGOTIATED DEVELOPMENT OF A CONSENSUS SYSTEM MODEL WHICH DEFINES THE FRAMEWORK FOR THE DECISION-DRIENTED ANALYSIS OF INFORMATION REQUIREMENTS. THE PROCESS OF INFORMATION ANALYSIS INVOLVES JOINT MANAGER-ANALYST ACTIVITIES WHICH ARE AIMED AT THE EXPLICATION OF THE IMPLICIT DECISION MODELS WHICH ARE USED FOR DECISION MAKING. (A) 12P, 16R.

COMMENTS:

THIS PAPER PRESENTS A THEORETICAL DISCUSSION OF A TECHNIQUE FOR THE DESIGN OF MANAGEMENT INFORMATION SYSTEMS. ALTHOUGH THIS TECHNIQUE HAS NOT BEEN TESTED, IT APPEARS TO CONTAIN SEVERAL VIABLE AND USEFUL CONCEPTS. THE FOCUS OF THIS PAPER IS ON DEVELOPING TECHNIQUES FOR MORE EFFECTIVE USER REQUIREMENTS ANALYSIS AND ON INVOLVING THE ULTIMATE USERS OF THE SYSTEM IN THE ENTIRE SYSTEM DEVELOPMENT PROCESS.

272 AUTOMATED AIDS FOR PLANNING

KLEINE, H., & CITRENBAUM, R.L. INTERACTIVE MANAGEMENT PLANNING. IN H. SACKMAN & R.L. CITRENBAUM (EDS.), ONLINE PLANNING: TOWARDS CREATIVE PROBLEM SOLVING. ENGLEWOOD CLIFFS, NEW JERSEY: PRENTICE-HALL, 1972, 251-278. DESCRIPTION:

AN OVERVIEW OF STRATEGIC MANAGEMENT PLANNING IS PRESENTED BY INDICATING THE ROLE OF MANAGEMENT ALONG WITH A CONCEPTUAL FRAMEWORK FOR PLANNING. THE STRATEGIC DEVELOPMENT OF A PLAN VIA TREE REPRESENTATION AND THE GEOMETRIC INTERPRETATION OF THE RESULTING "WINDOW EFFECT" ARE INDICATED. THIS IS FOLLOWED BY BRIEF REMARKS ON THE MAN-MACHINE INTERFACE IN INTERACTIVE PLANNING.

ON THE BASIS OF THE HIERARCHICAL STRUCTURE OF PLANNING, AN APPROACH TOWARD AN INTERACTIVE COORDINATION SYSTEM FOR MANAGEMENT PLANNING IS OUTLINED. INITIAL CONSIDERATIONS AND ELEMENTS OF SUCH A SYSTEM, AS WELL AS EXAMPLES OF MANAGEMENT ORGANIZATION UTILIZING THE SYSTEM ARE PRESENTED. THE FEASIBILITY OF HANDLING STRUCTURAL ASSIGNMENTS, RETRIEVING INFORMATION, AND PRODUCING STATUS REPORTS IS IMDICATED. IN ADDITION, THE GENERALITY OF THE SYSTEM IS STRESSED, AND INCLUSION OF PROBLEM-SPECIFIC PLANNING TECHNIQUES SUCH AS DELPHI, PERT-CPM, GAMING, AND SIMULATION IS DISCUSSED. (A)

28P, 8R.

PLANNING IS AN INTERESTING TYPE OF PROBLEM-SOLVING TASK. IN MANY TASKS (E.G., CHESS) THE PROBLEM SOLVER HAS AVAILABLE A WELL-DEFINED LIST OF OPERATIONS THAT CAN BE USED TO GENERATE ALTERNATIVES, AND THESE ALTERNATIVES ARE CLEARLY DEFINED AND CAN READILY BE EVALUATED. IN PLANNING TASKS, THE OPERATIONS THAT CAN BE PERFORMED ARE NOT WELL-DEFINED. THE AUTHORS VIEW PLANNERS AS USING PROBLEM-REDUCTION METHODS AND SUGGEST THAT AN INTERACTIVE SYSTEM WOULD BE USEFUL IN HELPING TO MANAGE THE RESULTING HIERARCHY OF SUBGOALS. THIS PAPER CONTAINS SOME INTERESTING COMMENTS ON PLANNING AND

SUBGOALS. THIS PAPER CONTAINS SOME INTERESTING COMMENTS ON PLANNING AND WOULD BE RELEVANT TO THOSE INTERESTED IN THIS AREA OR IN THE MORE GENERAL AREA OF MAN-COMPUTER PROBLEM SOLVING.

273 REVIEW ON DATA ENTRY BY KEYBOARDS

KLEMMER, E.T. KEYBOARD ENTRY. APPLIED ERGONOMICS, 1971, 2, 2-6. DESCRIPTION:

MANY RECENT STUDIES OF KEYBOARD ENTRY ARE SUMMARIZED WITH PARTICULAR EMPHASIS ON PERFORMANCE DATA AND FUNDAMENTAL QUESTIONS ABOUT THE DESIGN OF KEYBOARDS. THE ROLE OF AUDITORY AND VISUAL FEEDBACK AND PHYSIOLOGICAL MEASUREMENTS ARE REVIEWED. TYPICAL SPEED AND ERROR RATES ARE GIVEN FOR SEVERAL TYPES OF SITUATIONS AND OPERATORS. OTHER METHODS OF DATA ENTRY ARE CONSIDERED, AS ARE SOURCE DOCUMENTS, ORDERING OF KEYS, KEYBOARD INTERLOCKS, AND CHORD KEYBOARDS. THESE DATA SHOULD BE OF INTEREST TO ANYONE CONCERNED WITH THE DESIGN AND USE OF KEYBOARDS OR OTHER DATA ENTRY DEVICES. (A) 5P, 35R.

COMMENTS:

THIS PAPER PRESENTS A BRIEF REVIEW OF THE LITERATURE ON KEYBOARD DATA ENTRY. THE AUTHOR MAKES SEVERAL INTERESTING CONCLUSIONS. FOR EXAMPLE, IT IS NOTED THAT THE ORDERING OF KEYS HAS VERY LITTLE EFFECT WITH ALPHABETIC KEYBOARDS, BUT NUMERIC KEYBOARDS SHOULD BE IN A 3X3X2 MATRIX WITH 1,2,3 ON THE TOP ROW (AS IN TOUCH-TONE TELEPHONES). THE AUTHOR ALSO POINTS OUT THE NEED FOR ADDITIONAL RESEARCH IN THE TRAINING OF KEYBOARD OPERATORS AND THE ROLE OF FEEDBACK IN DATA ENTRY TASKS. THIS PAPER COULD BE A GOOD SOURCE FOR THOSE WISHING INFORMATION ON THE FACTORS AFFECTING KEYBOARD DATA ENTRY.

274 AUTOMATED SPEECH RECOGNITION

KLINGER, A. NATURAL LANGUAGE, LINGUISTIC PROCESSING, AND SPEECH UNDERSTANDING: RECENT RESEARCH AND FUTURE GOALS (REPORT NO. R-1377-ARPA). SANTA MONICA, CALIFORNIA: RAND CORP., DECEMBER 1973.

DESCRIPTION:

THE NATURE OF COMPUTER SCIENCE RESEARCH RELATED TO SPEECH UNDERSTANDING IS REVEALED THROUGH DISCUSSION OF THE FOLLOWING TOPICS: ARTIFICIAL INTELLIGENCE, COMPUTER PROCESSING OF NATURAL-LANGUAGE DATA, PROGRAMMING LANGUAGES FOR PROBLEM-SOLVING SYSTEMS, AND STRUCTURAL (CONTEXTUAL, LINGUISTIC) PATTERN RECOGNITION. AN IN-DEPTH SURVEY OF RECENT RESEARCH RESULTS THAT INCLUDES EXAMPLES OF DEDUCTION, TEXT RECOGNITION, AND DIALOGUE BY AND WITH COMPUTERS IS FOLLOWED BY DISCUSSION OF SPEECH DATA, APPLICATIONS OF UNDERSTANDING-SOFTWARE, AND SUGGESTIONS FOR FURTHER RESEARCH. (A) 52P, 63R.

COMMENTS:

THIS PAPER PRESENTS A REVIEW OF NATURAL-LANGUAGE PROCESSING AND AUTOMATED SPEECH UNDERSTANDING. THIS REVIEW, THOUGH BRIEF, GIVES A FAIRLY GOOD DESCRIPTION OF THE STATE OF THE ART IN THESE AREAS. SOME NECESSARY FACTORS IN DESIGNING SUCH SYSTEMS ARE PROPOSED AND AREAS WHERE ADDITIONAL RESEARCH IS REQUIRED ARE DISCUSSED. ALTHOUGH THIS IS NOT A CRITICAL REVIEW, IT PROVIDES A GOOD INTRODUCTION TO THE AREA OF NATURAL-LANGUAGE PROCESSING AND SPEECH RECOGNITION.

275 INFORMATION HANDLING IN LARGE DATA BASES

KOCHEN, M. SOME PROBLEMS IN INFORMATION SCIENCE WITH EMPHASIS ON ADAPTATION TO USE THROUGH MAN-MACHINE INTERACTION (TECHNICAL REPORT NO. AFCRL-64-87).
YORKTOWN HEIGHTS, NEW YORK: IBM WATSON RESEARCH CENTER, APRIL 1964. (NTIS NO. AD 600113)

DESCRIPTION:

COMPUTER SIMULATION BASED ON LIST-PROCESSING, THEORETICAL DISCUSSIONS DRAWING ON SOCIOLOGY AND THE PSYCHOLOGY OF COGNITION, ENGINEERING STUDIES OF SEMI-AUTOMATED LIBRARY SYSTEMS, AND MATHEMATICAL ANALYSIS APPLYING GRAPH AND AUTOMATIC THEORY, ALL WERE USED TO ATTACK VARIOUS ASPECTS OF THE FOLLOWING CONTROL PROBLEMS. HOW CAN RELEVANT INFORMATION IN THE INCREASINGLY COMPLEX ENVIRONMENT OF AN ORGANISM (MODELED AS AN AUTOMATON) BE INTERNALLY REPRESENTED, STORED/RECALLED, AND PROCESSED EFFICIENTLY SO THAT INCREASINGLY EFFECTIVE ACTIONS CAN RESULT?

THE FOLLOWING ACCOMPLISHMENTS ARE DISCUSSED: (1) SOME PROGRESS TOWARD A LOGICAL STRUCTURING OF INFORMATION SCIENCE AS AN EMERGENT DISCIPLINE; CLASSIFICATION OF TYPES OF DISCOURSE; MODELLING OF AN INFORMATION SYSTEM IN TERMS OF MEMORY, PROCESSOR AND COMPREHENDER SUBSYSTEMS GOVERNED BY SELF-REGULATORY PRINCIPLES; OPERATIONAL PERFORMANCE ANALYSES OF CERTAIN SPECIAL INFORMATION SYSTEMS. (2) SPECIFICATION AND CONSTRUCTION OF COMPUTER PROGRAMS FOR CONCEPT AND LANGUAGE LEARNING; SPECIFICATION AND CONSTRUCTION OF A GENERAL-PURPOSE EXPERIMENTAL INFORMATION SYSTEM STORING INFORMATION AS SENTENCES COMPOSED OF NAMES AND PREDICATES (AMNIPS). (3) CRITICAL SURVEY OF ASSOCIATIVE MEMORIES; THEOREMS ABOUT NEW AND IMPROVED KEY-TO-ADDRESS TRANSFORMATIONS, ABOUT A HARDWARE-SDFTWARE COMPROMISE TO MULTIPLE DESCRIPTOR RECORD RETRIEVAL. (4) ALGORITHMS, AND PROGRAMS BASED ON THEM, FOR GROUPING ITEMS WITH SIMILAR ATTRIBUTES. (5) PRACTICAL APPLICATIONS AND BY-PRODUCTS TO MINIMIZATION OF INTERCONNECTIONS IN ELECTRICAL ASSEMBLIES, THESAURUS CONSTRUCTION, CITATION TRAIL SEARCHING. (A) 211P. 16R.

COMMENTS:

THIS IS A COLLECTION OF 21 PAPERS DEALING WITH THE "KNOWLEDGE," "STORAGE/
RECALL", AND "PROCESSING" SUBSYSTEMS OF AN INFORMATION SYSTEM. THE
MAJOR CONCERN EXPRESSED IN THIS COLLECTION IS HOW TO MANIPULATE INFORMATION
IN A LARGE DATA BASE AND THE PRINCIPAL IDEA EXPRESSED HERE IS THAT BY
PROGRAMMING A COMPUTER TO "LEARN," THE CONSTRUCTION OF COMPREHENSIVE DATA
DATA BASES CAN BE AVOIDED. THIS IS AN IMPORTANT CONCERN, AND SOME PROGRESS
IN THIS AREA HAS BEEN MADE IN RECENT ARTIFICIAL INTELLIGENCE RESEARCH. MANY
OF THE THEORETICAL ARGUMENTS PRESENTED ARE DATED AND OF DOUBTFUL VALIDITY.
SOME OF THE IDEAS EXPRESSED IN THIS PAPER, HOWEVER, MAY BE OF INTEREST TO
THOSE CONCERNED WITH DATA ORGANIZATION AND THE USER INTERFACE WITH LARGE
DATA BASES.

276 DESIGN AND EVALUATION OF MANAGEMENT INFORMATION SYSTEMS
KRIEBEL, C.H. THE EVALUATION OF MANAGEMENT INFORMATION SYSTEMS (REPORT NO. RR-226). PITTSBURGH, PENNSYLVANIA: CARNEGIE-MELLON UNIVERSITY, MANAGEMENT SCIENCES RESEARCH GROUP, SEPTEMBER 1970. (NTIS NO. AD 723083)
DESCRIPTION:

DURING THE PAST DECADE, THE PHRASE "MANAGEMENT INFORMATION SYSTEM" OR THE ACRONYM "MIS" HAS BECOME INCREASINGLY POPULAR FOR DISCUSSIONS OF INFORMATION PROCESSING SUPPORT FOR MANAGEMENT ACTIVITIES. PRIMARY DEVELOPMENTS IN THE FIELD OF MIS HAVE BEEN PACED BY ADVANCES IN COMPUTER SYSTEM TECHNOLOGY. THE RATIONALE AND ECONOMIC UTILIZATION OF THIS TECHNOLOGY WITHIN MANAGEMENT ORGANIZATIONS HAS POSED SOME FUNDAMENTAL ISSUES FOR SYSTEM DESIGN, PARTICULARLY AMONG PROFESSIONALS WHO VIEW "DESIGN" AS A NORMATIVE SCIENCE. THIS ESSAY REVIEWS THESE ISSUES AS THEY RELATE TO THE STAGE IN DESIGN CALLED "EVALUATION." SPECIFICALLY, WHAT DOES THE LITERATURE PROPOSE ON MIS EVALUATION AND WHAT IS BEING DONE IN PRACTICE? WHAT IS THE STATE-OF-THE-ART TODAY? WHAT PROBLEMS LOOM AHEAD? (A) 23P, 35R.

COMMENTS:

THIS IS AN INFORMAL DISCUSSION OF THE PROBLEM OF EVALUATING MIS DESIGNS, ALTHOUGH MANY OF THE AUTHOR'S COMMENTS AND OBSERVATIONS COULD BE APPLIED TO OTHER TYPES OF SYSTEMS. A PRINCIPAL THESIS OF THIS PAPER IS THAT THE ULTIMATE USERS OF A SYSTEM MUST BE INVOLVED IN THE DESIGN PROCESS. THIS INVOLVEMENT IS ESSENTIAL IN EVALUATION SINCE AN MIS IS EVALUATED ON ITS ECONOMIC POTENTIAL AND THE ECONOMICS OF MANAGEMENT DECISION PROCESSES ARE NOT SUFFICIENTLY WELL UNDERSTOOD THAT THEY CAN BE MODELED INDEPENDENTLY. A SIMILAR ARGUMENT CAN BE MADE FOR A VARIETY OF SYSTEMS. IN ADDITION TO USER INVOLVEMENT IN DESIGN, THIS SUGGESTS THE NEED TO DEVELOP A BETTER UNDERSTANDING OF THE USERS' DECISION MAKING PROCESSES.

277 MAN-COMPUTER SOLUTION OF TRAVELING SALESMAN PROBLEM
KROLAK, P., FELTS, W., & MARBLE, G. A MAN-MACHINE APPROACH TOWARD SOLVING THE
TRAVELING SALESMAN PROBLEM. COMMUNICATIONS OF THE ACM, 1971, 14, 327-334.
DESCRIPTION:

THE TRAVELING SALESMAN PROBLEM BELONGS TO AN IMPORTANT CLASS OF SCHEDULING AND ROUTING PROBLEMS. IT IS ALSO A SUBPROBLEM IN SOLVING OTHERS, SUCH AS THE WAREHOUSE DISTRIBUTION PROBLEM. IT HAS BEEN ATTACKED BY MANY MATHEMATICAL METHODS WITH BUT MEAGER SUCCESS. ONLY FOR SPECIAL FORMS OF THE PROBLEM OR FOR PROBLEMS WITH A MODERATE NUMBER OF POINTS CAN IT BE SOLVED EXACTLY, EVEN IF VERY LARGE AMOUNTS OF COMPUTER TIME ARE USED. HEURISTIC PROCEDURES HAVE BEEN PROPOSED AND TESTED WITH ONLY SLIGHTLY BETTER RESULTS. THIS PAPER DESCRIBES A COMPUTER AIDED HEURISTIC TECHNIQUE WHICH USES ONLY A MODEST AMOUNT OF COMPUTER TIME IN REAL-TIME TO SOLVE LARGE (100-20D POINT) PROBLEMS. THIS TECHNIQUE TAKES ADVANTAGE OF BOTH THE COMPUTER'S AND THE HUMAN'S PROBLEM-SOLVING ABILITIES. THE COMPUTER IS NOT ASKED TO SOLVE THE PROBLEM IN A BRUTE FORCE WAY AS IN MANY OF TODAY'S HEURISTICS, BUT IT IS ASKED TO ORGANIZE THE DATA FOR THE HUMAN SO THAT THE HUMAN CAN SOLVE THE PROBLEM EASILY.

THE TECHNIQUE USED IN THIS PAPER SEEMS TO POINT TO NEW DIRECTIONS IN THE FIELD OF MAN-MACHINE INTERACTION AND IN THE FIELD OF ARTIFICIAL INTELLIGENCE. (A) BP, BR.

COMMENTS:

THIS PAPER PRESENTS A SIMPLE, CREATIVE, AND APPARENTLY EFFECTIVE APPROACH TO COOPERATIVE MAN-COMPUTER SOLUTION OF ONE CLASS OF PROBLEM. THE PRINCIPAL COMPONENTS OF THE APPROACH ARE: (1) COMPUTER GENERATION OF A GRAPHICAL DISPLAY OF THE PROBLEM, (2) DECOMPOSITION OF THE PROBLEM, BY THE COMPUTER, INTO SEVERAL LEVELS OF SMALL ("LOCAL") PROBLEMS WHICH CAN BE SOLVED OPTIMALLY WITH LITTLE EXPENSE AND RELATIVELY HIGH CONFIDENCE OF INCLUSION OF THESE SUBSOLUTIONS IN THE FINAL GLOBAL SOLUTION, (3) REARRANGEMENT AND COMBINATION OF THE LOCAL SOLUTIONS, UNDER USER CONTROL, INTO LARGER SOLUTION PATHS UNTIL A COMPLETE CANDIDATE SOLUTION IS DEFINED, AND (4) ITERATION, AS DESIRED, TO IMPROVE THE QUALITY OF THE SOLUTION. IT IS NOT IMMEDIATELY CLEAR HOW THIS PARTICULAR APPROACH SHOULD BE APPLIED TO PROBLEMS OF OTHER TYPES, BUT THE GENERAL PHILOSOPHY OF DECOMPOSITION, OPTIMAL SOLUTION OF "LOCAL" PROBLEMS, AND RECOMBINATION UNDER HUMAN CONTROL APPEARS TO BE BROADLY APPLICABLE. IN THIS PARTICULAR STUDY, THE COOPERATIVE APPROACH YIELDED SOLUTIONS WHICH COMPARED FAVORABLY WITH VERY EXPENSIVE MATHEMATICAL PROGRAMMING SOLUTIONS AND WERE BETTER THAN AUTOMATED HUMISTICS. COOPERATIVE SOLUTIONS WERE LESS EXPENSIVE THAN ALL FULLY COMPUTERIZED SOLUTIONS.

278 COMPARISON OF MARK-SENSE AND HANDPRINTED NUMERIC INPUT KULP, R.A., & KULP, M.J. A COMPARISON OF MARK SENSING AND HANDPRINTING CODING METHODS. IN PROCEEDINGS OF THE SIXTEENTH ANNUAL MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1972, 416-421.

THE PRESENT STUDY WAS CONDUCTED TO DETERMINE WHICH OF TWO CODING METHODS, HANDPRINTING (HP) OR MARK SENSING (MS), RESULTS IN THE MOST EFFICIENT AND ACCURATE INPUT CODING APPROACH. TEN EXPERIENCED TOLL TICKET OPERATORS SERVED AS SUBJECTS IN A REPEATED MEASURES DESIGN. THE SUBJECTS PERFORMED THE CODING AND KEYPULSING TASKS IN 15 TEST SESSIONS ON THE MS CONDITION AND 30 TEST SESSIONS ON THE HP CONDITION. THE DATA WERE ANALYZED IN TERMS OF CODING AND KEYPULSING TIME AND ERRORS, AND REJECTS. THE MS CODING METHOD WAS FOUND TO BE SIGNIFICANTLY FASTER THAN THE HP CODING METHOD. HOWEVER, THE HP KEYPULSING RATES WERE SIGNIFICANTLY FASTER THAN THE MS RATES. CONSIDERING THE TOTAL TASK (CODING AND KEYPULSING) THERE WERE NO SIGNIFICANT DIFFERENCES BETWEEN HP AND MS. THE RESULTS ARE DISCUSSED IN TERMS OF THE CONSTRAINTS PLACED UPON THE HP CONDITION AND THE STATE-OF-THE-ART OF OPTICAL CHARACTER READING EQUIPMENT. (A)

6P, 5R.

THE AUTHORS NOTE THAT, IN SOME TASK DOMAINS, THE QUALITY OF THE MAN-COMPUTER INTERACTION IS LIMITED BY THE HUMAN'S ABILITY TO INPUT DATA. ALTHOUGH THERE ARE SOME POSSIBLY MINOR DESIGN AND PROCEDURAL PROBLEMS WITH THE EXPERIMENT REPORTED HERE, THE CONCLUSION THAT THERE ARE NO OVERALL DIFFERENCES BETWEEN THE MARK SENSING AND HANDPRINTING CODING METHODS STUDIED IS PROBABLY VALID. THE SUBJECTS, HOWEVER, HAD PREVIOUSLY HAD EXTENSIVE EXPERIENCE WITH MARK SENSE METHODS AND NO PREVIOUS EXPERIENCE WITH CONSTRAINED HANDPRINTING. A STUDY THAT ALLOWED FOR MORE EXTENSIVE TRAINING IN THE HANDPRINTING METHOD MIGHT PRODUCE QUITE DIFFFRENT RESULTS.

279 KEYBOARD DESIGN
LADANY, S.P. A MODEL FOR OPTIMAL DESIGN OF KEYBOARDS. COMPUTERS AND OPERATIONS
RESEARCH, 1975, 2, 55-59.

DESCRIPTION:

THE PROBLEM OF OPTIMAL DESIGN OF KEYBOARDS IN WHICH THE VARIOUS CHARACTERS HAVE TO BE ALLOCATED TO GIVEN KEYS IS STATED AS A ZERO-ONE QUADRATIC ASSIGNMENT MODEL. THE SOLUTION DEPENDS ON THE JOINT PROBABILITY DISTRIBUTION OF THE TWO-STRING COMBINATIONS OF THE CHARACTERS THAT DESCRIBE THE INPUT DATA, AND ON KEY SERVICING TIME DATA WHICH CAN BE COMPILED FROM METHODS—TIME-MEASUREMENT STANDARDS. A FIRST FEASIBLE SOLUTION CAN BE DERIVED FROM A LINEAR ASSIGNMENT APPROXIMATION. THIS APPROXIMATION, WHEN BASED ON THE EXISTING ESTIMATES OF THE EXACT SERVICE TIMES MIGHT BE USED AS A LOW COST INDICATOR WHETHER THE FULL OPTIMIZATION SHOULD BE PURSUED. (A)

COMMENTS:

THIS PAPER CONCERNS THE ALLOCATION OF FUNCTIONS (E.G., CHARACTERS) TO PARTICULAR KEYS IN A KEYBOARD WHICH IS OTHERWISE ALREADY DESIGNED. THE AUTHOR CONTENDS THAT SUCH ALLOCATION CAN BE DONE OPTIMALLY BY ASSOCIATING CHARACTERS WHICH HAVE HIGHER RELATIVE FREQUENCY TO KEYS WHICH ARE SERVICED BY THE FINGERS HAVING THE HIGHEST WORK CAPACITIES (E.G., INDEX FINGERS). THE PARTICULAR SOLUTION METHOD WHICH IS PROPOSED HERE EMPHASIZES DIGRAM (TWO-CHARACTER SEQUENCE) FREQUENCIES AND SEEMS GENERALLY SOUND. IT WOULD APPEAR TO BE RESTRICTED TO ANALYSIS OF ALPHABETIC KEYBOARDS FOR USE BY TOUCH TYPISTS, HOWEVER, AS RESPONSE TIME WITH FUNCTION KEYBOARDS IS USUALLY NOT DOMINATED BY SUCH FACTORS AS DIGRAM KEYING RATES. IT IS CONCEIVABLE THAT SAMELAR OPTIMIZATION METHODS COULD BE USED FOR OTHER KEYBOARD SITUATIONS IF ABEQUATE SUPPORTING DATA ON DISCRIMINATIVE REACTION TIME AND OTHER RELEVANT FACTORS WERE AVAILABLE.

280 TIME-SHARING VS. BATCH PROCESSING
LAMPSON, B.W. A CRITIQUE OF "AN EXPLORATORY INVESTIGATION OF PROGRAMMER
PERFORMANCE UNDER ON-LINE AND OFF-LINE CONDITIONS". IEEE TRANSACTIONS ON
HUMAN FACTORS IN ELECTRONICS, 1967, HFE-8, 48-51.
DESCRIPTION:

THE PAPER BY GRANT AND SACKMAN (1967), "AN EXPLORATORY INVESTIGATION OF PROGRAMMER PERFORMANCE UNDER ON-LINE AND OFF-LINE CONDITIONS" IS DISCUSSED CRITICALLY. PRIMARY EMPHASIS IS ON THIS PAPER'S FAILURE TO CONSIDER THE MEANING OF THE NUMBERS OBTAINED. AN UNDERSTANDING OF THE NATURE OF AN ON-LINE SYSTEM IS NECESSARY FOR PROPER INTERPRETATION OF THE OBSERVED RESULTS FOR DEBUGGING TIME, AND THE RESULTS FOR COMPUTER TIME ARE CRITICALLY DEPENDENT ON THE IDIOSYNCRACIES OF THE SYSTEM ON WHICH THE WORK WAS DONE. LACK OF ATTENTION TO THESE MATTERS CANNOT BE COMPENSATED FOR BY ANY AMOUNT OF STATISTICAL ANALYSIS. FURTHERMORE, MANY OF THE CONCLUSIONS DRAWN AND SUGGESTIONS MADE ARE TOO VAGUE TO BE USEFUL. (A)

COMMENTS:

THIS IS A USEFUL CRITICISM. MANY OF THE POINTS IT MAKES APPLY TO OTHER EXPERIMENTAL STUDIES IN THIS AREA. THE PRINCIPAL CRITICISM WHICH THE AUTHOR OFFERS IS THAT THE EVALUATION OF A TIME-SHARING SYSTEM CAN BE GREATLY AFFECTED BY THE PARTICULAR METRICS SELECTED. IT IS NOT AT ALL CLEAR THAT THOSE EMPHASIZED BY GRANT AND SACKMAN ARE APPROPRIATE, SINCE THEY ARE GREATLY AFFECTED BY SOME PECULIARITIES OF THE SYSTEM ON WHICH THE STUDY WAS PERFORMED. THE EMPHASIS THROUGHOUT THIS PAPER IS ON THE NECESSITY TO RELATE SUCH EXPERIMENTAL STUDIES TO ACTUAL AND PROJECTED COMPUTER PRACTICES. IF, FOR EXAMPLE, COMPUTER COSTS ARE CALCULATED TO BE RELATIVELY HIGH FOR TIME-SHARING BASED ON THE USE OF AN INEFFICIENT AND EXPENSIVE TIME-SHARING SYSTEM, SUCH CALCULATED COSTS ARE MISLEADING. MOST OF THE CRITICISMS IN THIS PAPER WOULD APPLY TO ANY STUDY WHICH ATTEMPTS TO GENERALIZE FROM AN EXPERIMENT INVOLVING "FIXED" EFFECTS (I.E., WHICH COMPARES ONLY SPECIFIC IMPLEMENTATIONS OF THE UNDERLYING VARIABLE OF INTEREST). IT IS DIFFICULT TO SEE HOW CONTROLLED EXPERIMENTATION CAN BE DONE IN THIS AREA WITHOUT ENCOUNTERING SOME OF THESE PROBLEMS, BUT THIS PAPER ALSO POINTS OUT A FEW AVOIDABLE PITFALLS. IT SHOULD INTEREST THOSE CONCERNED WITH RESEARCH ON INTERACTIVE PROGRAMMING, AND WILL HELP THE MORE GENERAL READER TO PLACE THESE STUDIES IN THEIR PROPER PERSPECTIVE.

281 MULTIDIMENSIONAL EVALUATION OF DISPLAYS

LANDIS, D., SLIVKA, R.M., JONES, J.M., HARRISON, S., & SILVER, C.A. EVALUATION OF LARGE SCALE VISUAL DISPLAYS (TECHNICAL REPORT NO. RADC-TR-67-57). GRIFFISS AFB, ROME, NEW YORK: ROME AIR DEVELOPMENT CENTER, APRIL 1967. (NTIS NO. AD 651372) DESCRIPTION:

THE DEVELOPMENT OF A USABLE, VALID METRIC OF INFORMATION TRANSFER FROM LARGE-SCALE VISUAL DISPLYS IS DESCRIBED. THIS METRI: IS RELATED TO MULTIDIMENSIONAL ANALYTICALLY DERIVED RATING SCALES IN A SET OF REGRESSION EQUATIONS. THESE RATING SCALES ACCOUNT FOR APPROXIMATELY 50 PERCENT OF THE EXPLAINED VARIANCE OF THE METRIC, AND PERTINENT INFORMATION ABOUT THE DISPLAY OBSERVER ACCOUNTS FOR THE REMAINING SO PERCENT. IT WAS ALSO FOUND THAT THREE TRADITIONAL MEASURES OF DISPLAY EFFECTIVENESS, BASED ONLY ON INFORMATION ASSIMILATION, DO NOT ACCURATELY MEASURE THE EFFECTIVENESS OF DISPLAYS BECAUSE THEY FAIL TO CONSIDER THE ELEMENT OF DECISION QUALITY.

THE RESEARCH PRODUCED SEVERAL FINDINGS ABOUT THE CHARACTERISTICS OF EFFECTIVE DISPLAYS: SMALL DISPLAYS ARE APPROXIMATELY 8 TO 10 PERCENT MORE EFFECTIVE THEN LARGER EQUIVALENT DISPLAYS; THE USE OF NONREDUNDANT COLOR CODING INCREASES EFFECTIVENESS FROM 8 TO 13 PERCENT; EACH FACT ADDED TO A DISPLAY PRODUCES A CHANGE IN EFFECTIVENESS OF APPROXIMATELY 2 PERCENT; AND THE COMPRESSION OF SYMBOLS PRODUCES A 2 PERCENT INCREASE IN EFFECTIVENESS FOR EACH COMPRESSION STEP, WHICH CAN BE RAISED TO AS MUCH AS 3 PERCENT UNDER CONDITIONS OF HIGH INCENTIVE.

THE RESULTS INDICATE THAT, IF THE CRITICAL PARAMETERS OF DISPLAY EFFECTIVENESS (DETERMINED BY MULTIDIMENSIONAL ANALYSIS OF EACH RATING SCALE) ARE INCLUDED IN A REGRESSION MODEL, IT WOULD BE POSSIBLE TO PREDICT DISPLAY EFFECTIVENESS FROM ENGINEERING DATA, WITHOUT THE NECESSITY OF USING DISPLAY OBSERVERS IN AN EFFECTIVENESS-TESTING SITUATION. (A) 136P. 50R.

COMMENTS:

EVALUATING DISPLAY EFFECTIVENESS IN TERMS OF DECISION QUALITY, RATHER THAN THAN IN TERMS OF INFORMATION ASSIMILATION TIMES, IS AN INTERESTING CONCEPT. CLEARLY, DECISION QUALITY IS THE ULTIMATE GOAL, AND ITS SUCCESSFUL USE AS A DISPLAY-EVALUATION CRITERION WOULD BE AN IMPORTANT ACHIEVEMENT. IN THE EXPERIMENTS REPORTED HERS, "COSTS" AND "PROFITS" ARE ASSOCIATED WITH SUBJECTS' ACTIONS AND DECISION QUALITY IS DEFINED AS THE TOTAL PROFIT. THIS DEFINITION IS APPLICABLE TO A LIMITED NUMBER OF TASKS, AND HOW DECISION QUALITY COULD, IN GENERAL, BE DEFINED AND MEASURED IS NOT CONSIDERED. IT HAS BEEN REPEATEDLY DEMONSTRATED THAT THE EFFECTS OF DISPLAY SIZE, COLOR CODING, AND OTHER VARIABLES INCLUDED IN THESE EXPERIMENTS ARE TASK-DEPENDENT. THE EFFECTS REPORTED HERE, THEREFORE, SHOULD BE INTERPRETED IN THE CONTEXT OF THE SPECIFIC TASKS USED AND SHOULD NOT BE TAKEN AS GENERAL GUIDELINES.

282 GENERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
LASKA, T.J., & BOND, G.L. HUMAN FACTORS IN DATA PROCESSING SYSTEMS. SPERRY
ENGINEERING REVIEW, SPRING 1970, 55-61.
DESCRIPTION:

THIS PAPER PRESENTS AN INFORMAL DESCRIPTION OF THE ROLE OF HUMAN FACTORS ENGINEERING IN THE ELECTRONIC DATA PROCESSING INDUSTRY. IT DISCUSSES THE USES OF BOTH BASIC AND APPLIED RESEARCH, GENERAL DATA COLLECTION TECHNIQUES, THE ORGANIZATION OF HUMAN FACTORS INFORMATION, PRODUCT DESIGN, AND PRODUCT IMPLEMENTATION.

7P, 6R.

THIS IS A VERY GENERAL, NON-TECHNICAL OVERVIEW OF THE ROLE OF HUMAN FACTORS PERSONNEL IN DATA PROCESSING SYSTEMS, RANGING FROM THE IDENTIFICATION OF PROBLEM AREAS TO THE IMPLEMENTATION OF NEW PRODUCTS. THIS PAPER PRESENTS NEITHER RESEARCH RESULTS NOR GUIDELINES IN THIS AREA. THIS PAPER MAY, HOWEVER, BE USEFUL AS AN INTRODUCTION TO HUMAN FACTORS ENGINEERING IN DATA PROCESSING SYSTEM DEVELOPMENT.

283 AUTOMATED SPEECH PROCESSING

LAVESON, J.I., & SILVER, C.A. THE EMPLOYMENT OF A SPOKEN LANGUAGE COMPUTER APPLIED TO AN AIR TRAFFIC CONTROL TASK. IN PROCEEDINGS OF THE 16TH ANNUAL MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1972, 410-415.

DESCRIPTION:

THE PURPOSE OF THIS STUDY WAS TO DETERMINE THE BENEFIT OF A LIMITED SPOKEN LANGUAGE COMPUTER IN A SIMULATED AIR TRAFFIC CONTROL (ATC) TASK. THE PERFORMANCE OF SUBJECTS ACTING AS CONTROLLERS WAS MEASURED BOTH WITH AND WITHOUT THE COMPUTER, WHICH WAS SIMULATED BY A HUMAN. AS APPLIED TO THE PARTICULAR ATC SYSTEM STUDIED, SUBJECT PERFORMANCE WAS SIMILAR BOTH WITH AND WITHOUT THE COMPUTER. THE RESULTS ARE DISCUSSED IN TERMS OF THE PRECISE INFORMATION, RIGID FORMAT, AND LOW REDUNDANCY OF THE LANGUAGE. THE MOST IMPORTANT NEED FOR FURTHER RESEARCH IS THE DEVELOPMENT AND EVALUATION OF LARGER AND LESS RESTRICTIVE VOCABULARIES FOR THE SYSTEMATIC EXPLORATION OF HUMAN INTERFACE REQUIREMENTS. (A, ABBR.)

COMMENTS:

THIS PAPER CONSIDERS AN INTERESTING TOPIC. ALTHOUGH THE RESULTS REPORTED APPEAR TO SUPPORT ARGUMENTS AGAINST DEVELOPING SYSTEMS THAT EMPLOY SPEECH AS A MAN-COMPUTER COMMUNICATION CHANNEL, THE CONCLUSIONS PRESENTED MAY BE UNWARRANTED. THE AUTHORS DO NOT DESCRIBE THE EXPERIMENTAL TASK OR PROCEDURES IN SUFFICIENT DETAIL TO ALLOW THE READER TO EVALUATE THIS RESEARCH. THE POTENTIAL PROBLEMS INVOLVED WITH USING A SIMULATED COMPUTER IN A SIMULATED TASK COULD HAVE SIGNIFICANT EFFECTS ON OBSERVED PERFORMANCE. THIS PAPER MAY, HOWEVER, BE OF SOME INTEREST TO ANYONE CONCERNED WITH AUTOMATED SPEECH PROCESSING AND PARTICULARLY TO THOSE PLANNING RESEARCH IN THIS AREA.

284 AUTOMATED SPEECH PROCESSING

LEA, W.A. ESTABLISHING THE VALUE OF VOICE COMMUNICATION WITH COMPUTERS. IEEE TRANSACTIONS ON AUDIO AND ELECTROACOUSTICS, 1968, AU-16, 184-197. DESCRIPTION:

VOICE COMMUNICATION WITH COMPUTERS PROVIDES MANY ADVANTAGES, PARTICULARLY FOR COMMUNICATING WITH JULTIFUNCTIONAL SPACEBORNE COMPUTERS. ADVANTAGES INCLUDE PROPER UTILIZATION OF THE ASTRONAUT'S (OR ANY COMPUTER USER'S) TRAINING AND EXPERIENCE WITH SPEECH, ADVANTAGES OF NATURAL-LANGUAGE MAN-COMPUTER COMMUNICATION, PHYSICAL MOBILITY PERMITTED TO THE BUSY ASTRONAUT, REASONABLE COMMUNICATION CAPACITIES OF THE VOICE CHANNEL, ADVANTAGES OF MULTI-MODAL COMMUNICATION, INCLUDING INCREASED RELIABILITY OF I/O SYSTEMS, POSSIBILITY OF MONITORING ASTRONAUT EMOTIONAL STATE, THE SMALL CLOSED SPACEBORNE ENVIRONMENT WITH NO OUTSIDE NOISE AND LIMITED POPULATION OF SPEAKERS, AND THE POTENTIAL FOR VOICE I/O UNDER VARIOUS ACCELERATIONS. IN CONTRAST, DIFFICULTIES OF ORAL COMMUNICATION WITH COMPUTERS INCLUDE INTERFERENCE OF AUDITORY NOISE, LACK OF ANY DIRECT PERMANENT RECORD OF WHAT HAS BEEN SPOKEN, DIFFICULTIES OF COMPUTER HANDLING OF VERSATILE NATURAL LANGUAGES, AND INCREASED DEMAND FOR COMPUTER STORAGE AND PROCESSING CAPABILITIES.

A SYSTEM FOR EXPERIMENTALLY COMPARING SPEECH PARAMETER EXTRACTION TECHNIQUES HAS BEEN IMPLEMENTED AND SHOULD PROVIDE VALUABLE RESULTS CONCERNING THE POTENTIAL FOR SUCCESSFUL SPEECH RECOGNITION BY COMPUTER.

THE FINAL TEST OF THE VALUE OF THE ORAL MAN-COMPUTER COMMUNICATION LINK WILL BE WHETHER HUMAN USERS ACCEPT AND USE IT WITH SOME EASE. BEHAVIORAL INVESTIGATION OF THE OPERATIONAL ACCEPTABILITY OF VOICE I/O UNDER VARIOUS RESTRICTIONS ON THE COMMUNICATION AND COMMAND LANGUAGES USED WILL PROVIDE PRECISE MEASURES OF THE POTENTIAL SUCCESS OF RESTRICTED VOICE I/O SYSTEMS. (A)

14P, 22R.

COMMENTS:

THIS PAPER REVIEWS SOME OF THE ADWANTAGES AND DISADVANTAGES OF SPOKEN MAN-COMPUTER DIALOGUE. THE PRIMARY EMPHASIS IS ON COMPUTATIONAL ASPECTS OF NATURAL SPEECH PROCESSING. VARIOUS THEORIES OF THE RELEVANT PARAMETERS OF SPEECH ARE DISCUSSED AND A SYSTEM FOR COMPARING THESE THEORIES IS DESCRIBED. THE AUTHOR CONCLUDES THAT NATURAL SPEECH DIALOGUE WILL BE RESTRICTED IN TERMS OF VOCABULARY, SYNTAX, SEMANTICS, AND RATE OF SPEECH AND NOTES THAT IT IS NECESSARY TO CONSIDER THE EFFECTS OF THESE RESTRICTIONS ON THE USER.

285 HUMAN FACTORS INVOLVEMENT IN DESIGN OF CRT TERMINAL
LE COCQ, A.D. THE DESIGN OF A CRT COMPUTER TERMINAL: A HUMAN FACTORS DREAM
OR NIGHTMARE? IN PROCEEDINGS OF THE 21ST ANNUAL MEETING OF THE HUMAN FACTORS
SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1977, 164-166.
DESCRIPTION:

DESIGNING A CRT-TYPE COMPUTER TERMINAL WITHIN A SHORT PERIOD OF TIME IS A SIGNIFICANT CHALLENGE TO ENGINEERS, THE MARKETING STAFF, AND THE HUMAN FACTORS SPECIALISTS. DURING THE ENTIRE DESIGN PHASE OF A NEW CRT TERMINAL, HUMAN FACTORS REQUIREMENTS WERE GENERATED USING A NUMBER OF TECHNIQUES INCLUDING EMPIRICAL STUDIES, EVALUATIONS, AND APPLICATION OF BASIC HUMAN FACTORS DATA AND TECHNIQUES. THIS PAPER (1) DESCRIBES IN DETAIL HOW THE HUMAN FACTORS REQUIREMENTS WERE DETERMINED, AND (2) ILLUSTRATES HOW HUMAN FACTORS CAN HAVE TOTAL INVOLVEMENT IN A PRODUCT, FROM INITIAL CONCEPTUALIZATION TO HARDWARE TESTING. (A) 3P, DR.

COMMENTS:

THIS IS AN EXTREMELY BRIEF DESCRIPTION OF THE APPLICATION OF HUMAN FACTORS TO THE DESIGN OF A CRT TERMINAL. ONE NOTEWORTHY ASPECT OF THIS APPROACH IS THE EARLY AND CONTINUAL INVOLVEMENT OF POTENTIAL USERS IN ALL PHASES OF DESIGN AND DEVELOPMENT. ALTHOUGH NO GENERAL GUIDELINES FOR TERMINAL DESIGN ARE PRESENTED, THE METHODOLOGY DUTLINED IN THIS PAPER COULD CONVENIENTLY AND PROFITABLY BE APPLIED TO ALMOST ANY ASPECT OF AN INTERACTIVE SYSTEM.

286 GENERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
LEDGARD, H., & SINGER, A. THE CASE FOR HUMAN ENGINEERING (TECHNICAL REPORT
77-11). AMHERST, MASSACHUSETTS: UNIVERSITY OF MASSACHUSETTS, COMPUTER AND
INFORMATION SCIENCE DEPARTMENT, SEPTEMBER 1977.
DESCRIPTION:

TYPICALLY, IN COMPUTER SYSTEMS, LITTLE ATTENTION IS GIVEN TO THE DESIGN OF THE HUMAN INTERFACE. CONSEQUENTLY, SYSTEMS ARE DIFFICULT TO MASTER AND UNPLEASANT TO USE. THE CONTINUING LACK OF AN ORGANIZED BODY OF HUMAN FACTORS KNOWLEDGE THAT COULD GUIDE SYSTEM DESIGNERS MAKES IT UNLIKELY THAT THINGS WILL IMPROVE.

THE BASIC CONTEMTION OF THIS PAPER IS THAT MUCH GREATER PRIORITY MUST BE GIVEN TO RESEARCH IN THE HUMAN ENGINEERING OF COMPUTER SYSTEMS. THE PAPER DISCUSSES THE KINDS OF PROBLEMS CAUSED BY POOR HUMAN ENGINEERING, EXAMINES THE RESULTING COSTS, AND PROVIDES THE BEGINNINGS OF AN ANNOTATED HUMAN FACTORS BIBLIORAPHY FOR SYSTEM DESIGNERS. (A) 38P, 45R.

COMMENTS:

THIS IS A BRIEF PAPER WHICH DISCUSSES SOME OF THE OBVIOUS AND HIDDEN COSTS OF INADEQUATE ATTENTION TO HUMAN FACTORS CONSIDERATIONS IN THE DESIGN OF INTERACTIVE COMPUTER SYSTEMS. THERE IS LITTLE IN THE DISCUSSION WHICH IS NEW TO HUMAN FACTORS SPEICALISTS, BUT IT IS A WELL WRITTEN ARGUMENT WHICH MIGHT INFLUENCE THE THINKING OF THOSE LESS FAMILIAR WITH THE FIELD. THE PAPER ALSO CONTAINS 38 REFERENCE CITATIONS ON HUMAN FACTORS IN COMPUTER SYSTEMS, WITH BRIEF ANNOTATIONS.

287 SIMULATION TOOL FOR USER REQUIREMENTS DEFINITION
LENOROVITZ, D.R., & RAMSEY, H.R. A DIALOGUE SIMULATION TOOL FOR USE IN THE
DESIGN OF INTERACTIVE COMPUTER SYSTEMS. IN PROCEEDINGS OF THE 21ST ANNUAL
MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS
SOCIETY, 1977, 95-99.
DESCRIPTION:

A RECURRENT PROBLEM IN DESIGNING INTERACTIVE COMPUTER SYSTEMS IS THE INABILITY OF SYSTEM DESIGNERS, USERS, AND IMPLEMENTORS TO OBSERVE THE SYSTEM'S EXTERNAL BEHAVIOR UNTIL IMPLEMENTATION HAS OCCURRED. THIS, IN TURN, OFTEN RESULTS IN FAILURE TO DETECT DESIGN DEFICIENCIES UNTIL A POINT WHEN CORRECTIONS ARE COSTLY OR IMPRACTICAL. A SIMULATION TOOL IS DESCRIBED WHICH ALLOWS A SYSTEMS DESIGNER TO INTERACTIVELY SPECIFY, IMPLEMENT, DEMONSTRATE, EVALUATE, AND ITERATIVELY MODIFY AN OPERATIONAL SIMULATION OF THE PROPOSED SYSTEM'S USER-COMPUTER INTERFACE. THE TOOL IS INTENDED FOR HANDS-ON USAGE BY AN APPLICATIONS-ORIENTED SYSTEMS DESIGNER WITH LITTLE OR NO FORMAL TRAINING IN COMPUTER SOFTWARE PROGRAMMING. THE CAPABILITIES AND CHARACTERISTICS OF THE TOOL ARE DESCRIBED ALONG WITH AN ECONOMICAL AND EFFICIENT APPROACH TO ITS DESIGN AND IMPLEMENTATION. (A)

SP, 17R.

COMMENTS:

THIS PAPER DESCRIBES A PROPOSED SYSTEM THAT COULD PROVIDE A FORMAL, FLEXIBLE METHOD FOR USER REQUIREMENTS DEFINITION. THIS SYSTEM, CALLED THE INTERACTIVE DIALOGUE SYNTHESIZER (IDS), WOULD ALLOW THE SYSTEM DESIGNER TO INTERACTIVELY MODIFY AND DESCRIBE VARIOUS ASPECTS OF THE DIALOGUE AND WOULD ALLOW THE EVENTUAL USERS OF THE SYSTEM UNDER DESIGN TO BE ACTIVELY INVOLVED IN THE DESIGN PROCESS. ALTHOUGH THIS SYSTEM IS MORE GENERAL THAN EXISTING METHODS FOR DIALOGUE CONTROL AND SPECIFICATION, ITS IMPLEMENTATION WOULD REQUIRE SIGNIFICANT EFFORT.

288 DECISION AIDING IN TACTICAL INFORMATION SYSTEM
LEVIT, R.A., ALDEN, D.G., ERICKSON, J.M., & HEATON, B.J. DEVELOPMENT AND
APPLICATION OF A DECISION AID FOR TACTICAL CONTROL OF BATTLEFIELD OPERATIONS
(VOL 1): A CONCEPTUAL STRUCTURE FOR DECISION SUPPORT IN TACTICAL OPERATIONS
SYSTEMS. MINNEAPOLIS, MINNESOTA: HONEYWELL SYSTEMS AND RESEARCH CENTER, AUGUST
1974.

DESCRIPTION:

A COMPREHENSIVE REVIEW OF DECISION AIDING IN HUMAN/COMPUTER ENVIRONMENT WAS CONDUCTED TO DEVELOP PRINCIPLES OF DECISION AIDING FOR THE ARMY RESEARCH INSTITUTE'S SIMULATED TACTICAL OPERATIONS SYSTEM (SIMTOS). AN ANALYSIS OF THE LITERATURE REVEALED THAT THE INTEGRATION OF A SINGLE DECISION AIDING CONCEPT INTO A TACTICAL OPERATIONS SYSTEM WAS INADEQUATE FOR OPTIMAL INTERACTIVE DECISION MAKING. A COMPLEX OF DECISION AIDS, INTEGRATED INTO A DECISION SUPPORT SYSTEM, IS NECESSARY TO OPTIMIZE THE TACTICAL PERFORMANCE OF THE HUMAN/COMPUTER DECISION MAKING UNIT. (A) 108P, 98R.

COMMENTS:

THERE ARE TWO IMPORTANT PREREQUISITES TO DEVELOPING EFFECTIVE AIDS FOR A DECISION MAKING, OR PROBLEM SOLVING, TASK. THE FIRST IS THAT WE DEVELOP A THOROUGH UNDERSTANDING OF THE TASK OF CURRENT INTEREST AND THE SECOND IS THAT WE UNDERSTAND THE COGNITIVE PROCESSES AND STRUCTURES THAT THE HUMAN PROBLEM SOLVER WILL, OR COULD, USE IN THIS TASK. UNLESS THESE PREREQUISITES ARE SATISFIED, THE DEVELOPMENT OF DECISION MAKING AIDS IS A TRIAL AND ERROR PROCESS WITH LITTLE PROBABILITY OF SUCCESS. IN THE RESEARCH DESCRIBED IN THIS PAPER, ONLY VERY CURSORY ATTENTION IS GIVEN TO THE FIRST PREREQUISITE. THE RELEVANCE OF RESEARCH ON COGNITIVE STRUCTURES AND PROCESSES IS REJECTED, OR AT LEAST IGNORED. THIS STATE OF AFFAIRS IS ALSO EVIDENT IN THE SEVENTEEN STUDIES BRIEFLY REVIEWED IN THIS PAPER. ADMITTEDLY, THERE IS OFTEN A LONG DELAY BETHEN THE DEVELOPMENT OF POTENTIALLY RELEVANT BASIC RESEARCH RESULTS AND THE APPLICATION OF THESE RESULTS TO TASK DOMAINS OF CURRENT INTEREST. A RESEARCH PROGRAM DIRECTED AT BRIDGING THIS GAP, HOWEVER, MAY WELL BE NO MORE TIME CONSUMING AND COSTLY THAN THE PROGRAM SUGGESTED IN THIS PAPER AND OFFERS THE PROMISE OF BEING MORE SUCCESSFUL.

SCIENCE APPLICATIONS INC ENGLEWOOD CO
A CRITICALLY ANNOTATED BIBLIOGRAPHY OF THE LITERATURE ON HUMAN --ETC(U)
MAY 78 H R RAMSEY, M E ATWOOD, P J KIRSHBAUM N00014-76-C-0866
SAI-78-070-DEN AD-A058 081 UNCLASSIFIED 3 OF 5 058081

289 DECISION AIDING IN TACTICAL INFORMATION SYSTEM
LEVIT, R.A., HEATON, B.J., & ALDEN, D.G. DEVELOPMENT AND APPLICATION OF
DECISION AIDS FOR TACTICAL CONTROL OF BATTLEFIELD OPERATIONS: DECISION SUPPORT
IN A SIMULATED TACTICAL OPERATIONS SYSTEM (SIMTOS). MINNEAPOLIS, MINNESOTA;
HONEYWELL SYSTEMS AND RESEARCH CENTER, NOVEMBER 1975.
DESCRIPTION:

THIS RESEARCH IS DIRECTED AT EXAMINING THE NATURE OF HUMAN-COMPUTER INTERACTIVE DECISION MAKING IN AN AUTOMATED TACTICAL FRAMEWORK. A DECISION SUPPORT COMPLEX CONSISTING OF ADAPTIVE ESTIMATES OF THE SITUATION AND RESOURCE ALLOCATION DECISION AIDS WAS DEVELOPED AND INTEGRATED INTO THE ARMY RESEARCH INSTITUTE'S SIMULATED TACTICAL OPERATIONS SYSTEM (SIMTOS). AN EXPERIMENT WAS CONDUCTED TO COMPARE THE EFFECTS OF THE VARIOUS TYPES OF DECISION SUPPORT ON TACTICAL INFORMATION PROCESSING AND DECISION MAKING PERFORMANCE. ALTHOUGH CONCLUSIONS WERE NOT DEFINITIVE DUE TO THE INSENSITIVITY OF SYSTEM TACTICAL PERFORMANCE MEASURES, THE EFFICACY OF AN INTERACTIVE DATA BASE WITH DECISION SUPPORT NECHANISMS WAS SHOWN. (A, ABBR.) 77P, 8R.

COMMENTS:

THIS RESEARCH IS AN APPLICATION OF THE CONCEPTS DEVELOPED BY R.A. LEVIT, D.G. ALDEN, J.M. ERICKSON, & B.J. HEATON (1974). THE DESCRIBED STUDY YIELDED THREE IMPORTANT RESULTS. FIRST, THERE WERE NO PERFORMANCE DIFFERENCES AS A FUNCTION OF DECISION AIDS PROVIDED; SECOND, SUBJECTS DID NOT MAKE EXTENSIVE USE OF THE AIDS PROVIDED; AND THIRD, PERFORMANCE IS NOT AIDED BY OPERATOR INTERACTION IN THE SIMULATED TACTICAL OPERATION. THERE ARE AT LEAST THREE PLAUSIBLE REASONS FOR THESE RESULTS. THE FIRST IS THAT SIMTOS, AS APPLIED HERE, DOES NOT PROVIDE AN ADEQUATE SIMULATION OF A TACTICAL OPERATION; THE SECOND IS THAT THE AIDS PROVIDED DO NOT CORRESPOND TO THE OPERATOR'S DECISION MAKING PROCESSES; THE THIRD IS THAT THE AIDS DO CORRESPOND TO THE OPERATOR'S DECISION MAKING PROCESSES, BUT THEY ARE NOT CONSISTENTLY USED. FOR EXAMPLE, AIDS THAT ARE DIFFICULT TO USE MAY BE AVOIDED BY THE OPERATORS. RESOLUTION OF SUCH ISSUES WOULD APPEAR TO REQUIRE THE DEVELOPMENT OF A COMPREHENSIVE THEORETICAL FRAMEWORK TO EXPLAIN BEHAVIOR IN A GIVEN TASK DOMAIN THE USE OF SUCH A FRAMEWORK TO MOTIVATE EMPIRICAL RESEARCH.

290 TACTICAL OPERATIONS SYSTEM

LEVIT, R.A., HEATON, B.J., & ALDEN, D.G. DEVELOPMENT AND APPLICATION OF

DECISION AIDS FOR TACTICAL CONTROL OF BATTLEFIELD OPERATIONS: DECISION SUPPORT

IN A SIMULATED TACTICAL OPERATIONS SYSTEM (SINTOS): APPENDICES. MINNEAPOLIS,

MINNESOTA: HONEYWELL SYSTEMS AND RESEARCH CENTER, NOVEMBER 1975.

THIS VOLUME OF APPENDICES COMPLEMENTS THE PRIMARY TEST (R.A. LEVIT, B.J. HEATON, & D.G. ALDEN, 1975). APPENDIX 1 CONTAINS A "HANDBOOK FOR RESEARCH IN A SIMTOS." THE HANDBOOK DOCUMENTS OPERATIONS AND PROCEDURES WHICH HAVE BEEN USED IN A SIMTOS RESEARCH PROGRAM AND MAY, THEREFORE, BE USEFUL TO OTHER SIMTOS RESEARCHERS. APPENDIX 2 CONTAINS THE DECISION AIDING SOFTWARE SPECIFICATIONS USED TO DEVELOP THE DECISION SUPPORT COMPLEX EVALUATED IN THE EXPERIMENT PROGRAM. ALSO INCLUDED IN THIS APPENDIX ARE A SET OF PROPOSED PRELIMINARY SPECIFICATIONS FOR ADVANCED DECISION SUPPORT IN SIMTOS. APPENDIX 3 CONTAINS THE METHODS USED TO DERIVE THE PLANNING SEGMENT INFORMATION PROCESSING MEASURES, AND THE COMBAT SEGMENT TACTICAL PERFORMANCE AND INFORMATION PROCESSING MEASURES. (A) 149P, DR.

COMMENTS:

DESCRIPTION:

IN EVALUATING AN EMPIRICAL STUDY, IT IS OFTEN VERY USEFUL TO HAVE ACCESS TO A DETAILED DESCRIPTION OF THE EXPERIMENTAL PROCEDURES USED. THIS DOCUMENT PROVIDES SUCH A DESCRIPTION. ON THE BASIS OF THE INSTRUCTIONS GIVEN TO SUBJECTS, SOME OF THE DECISION AIDS PROVIDED APPEAR TO BE VERY DIFFICULT TO USE. THERE WAS APPARENTLY VERY LITTLE CONSIDERATION OF HUMAN FACTORS ASPECTS OF THE OPERATOR-COMPUTER INTERFACE. IN ADDITION, THE SIMULATED TACTICAL OPERATION INCORPORATED SIMPLIFICATIONS THAT MAY WELL HAVE RESULTED IN A VERY INACCURATE SIMULATION OF AN ACTUAL OPERATION.

DECISION AIDING IN TACTICAL INFORMATION SYSTEM
LEVIT, R.A., HEATON, B.J., ALDEN, D.G., & GRANDA, T.M. ELEMENTS OF DECISION
SUPPORT IN A SIMULATED TACTICAL OPERATIONS SYSTEM (SIMTOS). IN PROCEEDINGS,
HUMAN FACTORS SOCIETY, 19TH ANNUAL MEETING. SANTA MONICA, CALIFORNIA:
HUMAN FACTORS SOCIETY, 1975, 329-332.
DESCRIPTION:

TWO ELEMENTS OF DECISION SUPPORT WERE INTEGRATED INTO THE ARMY RESEARCH INSTITUTE'S SIMULATED TACTICAL OPERATIONS SYSTEM (SIMTOS). THE ESTIMATE OF THE SITUATION ELEMENT PROVIDED THE TACTICAL DECISION MAKER WITH RELEVANT INFORMATION IN A FORMAT COMPLEMENTARY TO HIS DECISION STYLE. A RESOURCE ALLOCATION ELEMENT ENABLED THE TACTICAL DECISION MAKER TO SURVEY HIS TACTICAL RESPONSE ALTERNATIVES AND TO RAPIDLY IMPLEMENT A CHOSEN ALTERNATIVE. A PRELIMINARY INVESTIGATION (N=10) INDICATES THAT TACTICAL DECISION MAKERS WHO USED THE DECISION SUPPORT COMPLEX PERFORMED MORE EFFECTIVELY THAN THOSE WHO DID NOT USE THE COMPLEX. (A) 4P, 6R.

COMMENTS:

THIS IS A PRELIMINARY EXPERIMENT TO EVALUATE DECISION AIDS FOR SIMTOS. A FOLLOW-ON EXPERIMENT IS DESCRIBED IN SOME DETAIL IN R.A. LEVIT, B.J. HEATON, AND D.G. ALDEN (1975). THIS LATTER PAPER, AND ESPECIALLY AN EARLIER PAPER BY R.A. LEVIT, D.G. ALDEN, J.M. ERICKSON, AND B.J. HEATON (1974) PROVIDE MORE EXTENSIVE DISCUSSIONS OF SIMTOS AND ASSOCIATED DECISION MAKING AIDS.

292 COMPUTER PRINTOUT READABILITY
LEWIS, R.A. LEGIBILITY OF CAPITAL AND LOWERCASE COMPUTER PRINTOUT. JOURNAL OF
APPLIED PSYCHOLOGY, 1972, 56, 280-281.
DESCRIPTION:

THE LEGIBILITY OF CAPITAL AND LOWERCASE COMPUTER PRINTOUT WAS INVESTIGATED USING THE CHAPMAN-COOK SPEED OF READING TEST. READING PERFORMANCE WAS HIGHER FOR AVERAGE 30-SPACE LINES THAN FOR 10-, 20-, 40-, AND 50-SPACE LINES. ORIGINAL SIZE TYPE (100%) LED TO BETTER PERFORMANCE THAN TYPE PHOTOGRAPHICALLY REDUCED TO 75% OR 50% OF ORIGINAL 12-POINT SIZE. NO BEST COMBINATION OF LINE LENGTH AND TYPE SIZE WAS IDENTIFIED. (A) 2P, 8R.

COMMENTS:

THE EXPERIMENT REPORTED IN THIS PAPER APPEARS TO HAVE BEEN CAREFULLY CONDUCTED. ALTHOUGH A FAIR AMOUNT OF RESEARCH HAS BEEN DONE ON THE LEGIBILITY OF CONVENTIONAL TYPEFACES, LITTLE HAS BEEN DONE ON THE LEGIBILITY OF LINE-PRINTER TYPEFACES. AS THE AUTHOR NOTES, LINE-PRINTER TYPEFACES DIFFER FROM CONVENTIONAL TYPEFACES ON SEVERAL POTENTIALLY IMPORTANT FACTORS; FOR EXAMPLE, LINE-PRINTER TYPE IS GENERALLY OF LOWER QUALITY AND CHARACTERS ARE SPACED UNIFORMLY RATHER THAN PROPORTIONALLY. ALTHOUGH THE AUTHOR REPORTS THAT NO OPTIMAL COMBINATION OF LINE LENGTH AND TYPE SIZE WAS FOUND, IT IS NOT CLEAR, ON THE BASIS OF THIS PAPER, WHETHER THIS CONCLUSION IS JUSTIFIED. IT SHOULD BE NOTED THAT THIS EXPERIMENT INVOLVED A SINGLE TYPEFACE CONTAINING BOTH UPPERCASE AND LOWERCASE CHARACTERS AND DOES NOT, AS THE TITLE MAY IMPLY, COMPARE UPPERCASE AND LOWERCASE CHARACTERS.

293 IMAGE RETRIEVAL SYSTEMS
LICKER, P.S. MAN-COMPUTER PROCEDURES FOR IMAGE RETRIEVAL: PRELIMINARY
FINDINGS. IN PROCEEDINGS, 4TH MAN-COMPUTER COMMUNICATIONS CONFERENCE. OTTAWA,
ONTARIO, CANADA: NATIONAL RESEARCH COUNCIL, 1975, PP. 11-1 TO 11-6.
DESCRIPTION:

THE RESEARCH DESCRIBED IN THIS PAPER IS INTENDED TO UNCOVER DESIGN PARAMETERS CRITICAL FOR USER INTERACTION WITH A DATA BASE CONSISTING OF DIGITALLY-CNCODED IMAGES. EXPERIMENTS HAVE BEEN PERFORMED TO ESTABLISH AND STANDARDIZE TASKS FOR USERS OF IMAGE RETRIEVAL SYSTEMS. MEASURES OF THE PERFORMANCE OF THESE TASKS ARE USED TO COMPARE THE USABILITY AND USEFULNESS OF A SET OF FEATURES AND FACILITIES FOR PROCEDURES OF IMAGE RETRIEVAL. A MINI-COMPUTER-BASED IMAGE RETRIEVAL SYSTEM TO BE USED IN FURTHER EXPERIMENTAL RESEARCH IS DESCRIBED. THIS SYSTEM IS DESIGNED TO ENABLE PERFORMANCE OF THE SET OF STANDARDIZED RETRIEVAL TASKS PREVIOUSLY MENTIONED AS WELL AS TO PROVIDE FOR AUTOMATIC SUBJECT DATA COLLECTION DURING EXPERIMENTS. (A)

COMMENTS:

THE THEORETICAL CONCEPTS PRESENTED IN THIS PAPER ARE QUITE GOOD. THE BASIC INTENT IS TO TAXONOMIZE IMAGE RETRIEVAL TASKS AS TYPES OF PROBLEM SOLVING TASKS AND THEN INVESTIGATE THE PROBLEM SOLVING PROCESSES INVOLVED IN THESE TASKS. UNDERSTANDING A GIVEN TASK DOMAIN IS A NECESSARY PREFQUISITE FOR DEVELOPING EFFECTIVE MAN-COMPUTER INTERACTION. THIS PAPER IS TOO BRIEF, HOWEVER, TO CLEARLY ILLUSTRATE HOW THESE THEORETICAL CONCEPTS ARE BEING USED OR HOW THIS APPROACH WILL AFFECT THE DESIGN OF MAN-COMPUTER SYSTEMS.

294 GENERAL DISCUSSION OF MAN-COMPUTER COOPERATION
LICKLIDER, J.C.R. MAN-COMPUTER SYMBIOSIS. IRE TRANSACTIONS ON HUMAN FACTORS IN
ELECTRONICS, 1960, HFE-1, 4-11.
DESCRIPTION:

MAN-COMPUTER SYMBIOSIS IS AN EXPECTED DEVELOPMENT IN COOPERATIVE INTERACTION BETWEEN MEN AND ELECTRONIC COMPUTERS. IT WILL INVOLVE VERY CLOSE COUPLING BETWEEN THE HUMAN AND THE ELECTRONIC MEMBERS OF THE PARTNERSHIP. THE MAIN AIMS ARE (1) TO LET COMPUTERS FACILITATE FORMULATIVE THINKING AS THEY NOW FACILITATE THE SOLUTION OF FORMULATED PROBLEMS, AND (2) TO ENABLE MEN AND COMPUTERS TO COOPERATE IN MAKING DECISIONS AND CONTROLLING COMPLEX SITUATIONS WITHOUT INFLEXIBLE DEPENDENCE ON PREDETERMINED PROGRAMS. IN THE ANTICIPATED SYMBIOTIC PARTNERSHIP, MEN WILL SET THE GOALS, FORMULATE THE HYPOTHESES, DETERMINE THE CRITERIA, AND PERFORM THE EVALUATIONS. COMPUTING MACHINES WILL DO THE ROUTINIZABLE WORK THAT MUST BE DONE TO PREPARE THE WAY FOR INSIGHTS AND DECISIONS IN TECHNICAL AND SCIENTIFIC THINKING. PRELIMINARY ANALYSES INDICATE THAT THE SYMBIOTIC PARTNERSHIP WILL PERFORM INTELLECTUAL OPERATIONS MUCH MORE EFFECTIVELY THAN MAN ALONE CAN PERFORM THEM.

PREREQUISITES FOR THE ACHIEVEMENT OF THE EFFECTIVE, COOPERATIVE ASSOCIATION INCLUDE DEVELOPMENTS IN COMPUTER TIME SHARING, IN MEMORY COMPONENTS, IN MEMORY ORGANIZATION, IN PROGRAMMING LANGUAGES, AND IN INPUT AND OUTPUT EQUIPMENT. (A)

BP, 27R.

COMMENTS:

THIS IS, PERHAPS, THE MOST FREQUENTLY CITED PAPER IN THE LITERATURE ON MAN-COMPUTER INTERACTION. THE AUTHOR DEFINES "MAN-COMPUTER SYMBIOSIS" AND DISCUSSES THE PREREQUISITES FOR REALIZING A SYMBIOTIC RELATIONSHIP. THIS PAPER WAS INTENDED TO PRESENT A CHALLENGE AND SUGGEST QUESTIONS THAT MUST FE CONSIDERED. THE IMPACT OF THIS PAPER IS CLEARLY PRESENT IN THE MAN-COMPUTER INTERACTION LITERATURE. UNFORTUNATELY, THE HIGHLY COOPERATIVE MAN-COMPUTER INTERACTION FORESEEN HERE HAS PROVEN TO BE AN ELUSIVE GOAL.

295 GENERAL DISCUSSION OF MAN-COMPUTER COOPERATION
LICKLIDER, J.C.R. MAN-COMPUTER PARTNERSHIP. INTERNATIONAL SCIENCE AND
TECHNOLOGY, MAY 1965, NO. 41, 18-26.
DESCRIPTION:

UNTIL RECENTLY, EFFORTS TO CONSERVE THE VALUABLE TIME OF AN EXPENSIVE COMPUTER PRECLUDED AN INTERACTIVE PARTNERSHIP BETWEEN MAN AND HIGH-SPEED COMPUTING MACHINE. BUT MAN EXCELS IN THE HEURISTIC PHASES OF PROBLEM SOLVING WHILE THE COMPUTER EXCELS IN EXECUTING EXPLICIT PROCEDURES. ON THE FRONTIERS OF RESEARCH, HEURISTIC AND ALGORITHMIC INFORMATION PROCESSING ARE NOT EASILY SEPARATED, BUT NOW A HUMAN PROBLEM SOLVER CAN ASK A COMPUTER TO EXPLORE HIS HUNCHES. LARGE COMPUTERS ARE GENERALLY NEEDED TO HANDLE PROBLEM-ORIENTED LANGUAGES, LARGE FILES, AND COMPLEX PROBLEMS. THE COMPUTER COST IS SHARED AMONG MANY USERS AS THE MACHINE SHARES ITS AVAILABLE TIME. NEW KINDS OF DISPLAYS AND CONSOLES ENABLE MAN AND COMPUTER TO COMMUNICATE BY PRINTING OR WRITING OR BY DRAWING PICTURES AND SYMBOLS. SPECIAL TIME-SHARING PROGRAMS AND DYNAMIC DISPLAYS ARE STILL COSTLY. A WHOLE NEW COMMUNITY OF SOPHISTICATED USERS MAY PRODUCE RESULTS WORTHY OF THE EXPENSE. (0) 9P. OR.

COMMENTS:

THIS PAPER PROVIDES A GENERAL DISCUSSION OF THE STATE-OF-THE-ART OF MAN-COMPUTER INTERACTION DEVELOPMENTS IN THE EARLY 1960'S. THE PRIMARY AREAS DISCUSSED ARE TASK ALLOCATION, INTERACTIVE COMPUTING, TIME-SHARING, AND AREAS REQUIRING FURTHER RESEARCH. THIS PAPER WOULD BE RELEVANT PRIMARILY TO THOSE INTERESTED IN THE HISTORY OF INTERACTIVE SYSTEMS.

296 GRAPHICAL INPUT

LICKLIDER, J.C.R. GRAPHIC INPUT: A SURVEY OF TECHNIQUES. IN F. GRUENBERGER (ED.), COMPUTER GRAPHICS. WASHINGTON, D.C.: THOMPSON BOOK CO., 1967, 39-69. DESCRIPTION:

THIS PAPER DESCRIBES EXISTING COMSOLES AND DISPLAY AND CONTROL COMPONENTS, CONTROL FEATURES, AND TECHNIQUES FOR GRAPHICAL IMPUT. FEATURES AND TECHNIQUES THAT HAVE NOT BEEN IMPLEMENTED, BUT WHICH ARE CONSIDERED DESIRABLE, ARE DISCUSSED. THESE FEATURES INCLUDE MULTIDIMENSIONAL ANALOG CONTROL, DESIGN BY MODIFYING PRESTORED SCHEMATA, AND AUTOMATIC REPLICATION OF REPETITIVE PATTERNS. A LANGUAGE FOR GRAPHICAL MAN-COMPUTER INTERACTION SHOULD INCLUDE A CHOICE OF INPUT CHANNEL BASED ON CONVENIENCE, PROVIDE SEPARATE MODES FOR EXPERT AND BEGINNER, AND REQUIRE TERSE INPUT BUT PROVIDE FULL, COMPLETE OUTPUT.

COMMENTS:

THIS PAPER PROVIDES A HISTORICAL OVERVIEW OF DISPLAY CONSOLES, DISPLAY AND CONTROL COMPONENTS, AND DISPLAY AND CONTROL FEATURES AND TECHNIQUES. THIS OVERVIEW IS FAIRLY COMPREHENSIVE AND IS EASY-TO-READ. THE AUTHOR ALSO SUGGESTS SEVERAL AREAS THAT REQUIRE ADDITIONAL ATTENTION. THIS PAPER WOULD BE PRIMARILY OF HISTORICAL INTEREST TO THOSE CONCERNED WITH INTERACTIVE GRAPHICS.

297 PROBLEMS WITH INFORMATION RETRIEVAL SYSTEMS LICKLIDER, J.C.R. INTERACTIVE INFORMATION PROCESSING, RETRIEVAL, AND TRANSFER. IN H.F. VESSEY AND I.J. GABELMAN (EDS.). STORAGE AND RETRIEVAL OF INFORMATION: A USER-SUPPLIER DIALOGUE (PROCEEDINGS OF A SYMPOSIUM SPONSERED BY THE AVIONICS AND TECHNICAL INFORMATION PANELS, NORTH ATLANTIC TREATY ORGANIZATION, MUNICH, 18-30 JUNE 1968) (AGARD CONFERENCE PROCEEDINGS NO. 39). PP. 151-167. (NTIS NO. AD 697621) DESCRIPTION:

THIS PAPER DESCRIBES THE PRESENT STATUS AND TRENDS OF MAN-COMPUTER INTERACTIVE INFORMATION PROCESSING, RETRIEVAL AND TRANSFER MADE POSSIBLE BY MULTI-ACCESS COMPUTERS, SOME OF THE PROMISES AND PROBLEMS OF INTERACTION ARE EXAMINED. THE MAIN ACTIVITY ON THIS FIELD IN THE U.S.A IS THE DEVELOPMENT OF HARDWARE-SOFTWARE SYSTEMS AND SUBSYSTEMS. EXAMPLES ARE DRAWN FROM THREE PROJECTS, MAC, TIP, AND INTREX AT THE MASSACHEUSETS INSTITUTE OF TECHNOLOGY.

## 17P, 17R. COMMENTS:

ALTHOUGH THE REVIEW PRESENTED IN THIS PAPER IS SOMEWHAT DATED, THE DISCUSSION CONTAINS SOME INTERESTING IDEAS. THE AUTHOR ARGUES THAT A MAJOR PROBLEM IN INFORMATION RETRIEVAL SYSTEMS IS THAT HUMAN MEMORY LIMITATIONS PREVENT THE RETRIEVAL INFORMATION FROM BEING ADEQUATELY PROCESSED. KE FURTHER ARGUES THAT THIS PROBLEM CALLS FOR ADDITIONAL RESEARCH IN THE REPRESENTATION OF KNOWLEDGE AND LANGUAGE PROCESSING. ABOUT THE TIME THIS PAPER WAS WRITTEN, THESE AREAS WERE BEING CONSIDERED IN THE DEVELOPMENT OF QUESTION-ANSWERING SYSTEMS IN THE FIELD OF ARTIFICIAL INTELLIGENCE. CURRENTLY, THESE AREAS ARE MAJOR CONCERNS IN THE AREA OF COGNITIVE PSYCHOLOGY. THIS PAPER WOULD BE OF INTEREST TO THOSE WHO WISH TO TRACE THE PROGRESS OF INTERACTIVE SYSTEMS.

GENERAL REVIEW OF MAN-COMPUTER COOPERATION LICKLIDER, J.C.R. MAN-COMPUTER COMMUNICATION. IN C.A. CUADRA (ED.), ANNUAL REVIEW OF INFORMATION SCIENCE AND TECHNOLOGY (VOL. 3). CHICAGO, ILLINOIS: ENCYCLOPEDIA BRITANNICA, 1968, 201-240. DESCRIPTION:

THIS IS A 1967 ANNUAL REVIEW OF DEVELOPMENTS IN MAN-COMPUTER COMMUNICATION THAT FOCUSES ON ON-LINE INTERACTION. THE CONCLUSIONS INDICATE THE NEED FOR LARGE-SCALE MULTI-ACCESS SYSTEMS, THE INTEGRATION OF INTERACTIVE PROGRAMS AT THE SYSTEMS LEVEL, STANDARDIZATION OF INTERACTIVE LANGUAGES, THE DEVELOPMENT OF INTERACTIVE GRAPHICS, AND MORE WORK IN THE AREAS OF MAN-COMPUTER INTERACTION TECHNIQUES AND ON-LINE PROBLEM SOLVING AND DECISION MAKING. 40P, 153R. COMMENTS:

THIS IS A GOOD, FAIRLY COMPREHENSIVE REVIEW OF THE FIELD OF MAN-COMPUTER INTERACTION. THIS REVIEW IS, OF COURSE, SOMEWHAT DATED. IT DOES, HOWEVER PROVIDE AN INTERESTING HISTORICAL PERSPECTIVE, AND IT WOULD BE USEFUL TO IT DOES, HOWEVER, ANYONE IN COMPARING AND CONTRASTING THE PROBLEMS AND CONCERNS EXPRESSED IN THIS PAPER WITH THOSE THAT EXIST TODAY.

299 GENERAL DISCUSSION OF MAN-COMPUTER COOPERATION
LICKLIDER, J.C.R., & CLARK, W.E. ON-LINE MAN-COMPUTER COMMUNICATION. AFIPS
CONFERENCE PROCEEDINGS, 1962, 21, 113-128.
DESCRIPTION:

ON-LINE MAN-COMPUTER COMMUNICATION REQUIRES MUCH DEVELOPMENT BEFORE MEN AND COMPUTERS CAN WORK TOGETHER EFFECTIVELY IN FORMULATIVE THINKING AND INTUITIVE PROBLEM SOLVING. THIS PAPER EXAMINES SOME OF THE DIRECTIONS IN WHICH ADVANCES CAN BE MADE AND DESCRIBES ON-GOING PROGRAMS THAT SEEK TO IMPROVE MAN-MACHINE INTERACTION IN TEACHING AND LEARNING, IN PLANNING AND DESIGN, AND IN VISUALIZING THE INTERNAL PROCESSES OF COMPUTERS. THE PAPER CONCLUDES WITH A BRIEF DISCUSSION OF BASIC PROBLEMS INVOLVED IN IMPROVING MAN-COMPUTER COMMUNICATION. (A)

COMMENTS:

THIS PAPER EXTENDS THE CONCEPT OF MAN-COMPUTER SYMBIOSIS INTRODUCED BY J.C.R. LICKLIDER (1960). ALTHOUGH THE REVIEW OF INTERACTIVE SYSTEMS PRESENTED IN THIS PAPER IS SOMEWHAT DATED, IT DOES PROVIDE A HISTORICAL PERSPECTIVE. IT IS ALSO INTERESTING TO CONSIDER THE "IMMEDIATE" AND "LONG-TERM" PROBLEMS DISCUSSED IN THIS PAPER. FOR THE MOST PART, IMMEDIATE PROBLEMS, SUCH AS THE DEVELOPMENT OF TIME-SHARING SYSTEMS, HAVE BEEN SOLVED. THE LONG-TERM PROBLEMS, SUCH AS NATURAL-LANGUAGE PROCESSING, HOWEVER, HAVE NOT BEEN SATISFACTORILY SOLVED ALTHOUGH WORK IS CURRENTLY IN PROGRESS ON SUCH PROBLEMS. THIS PAPER WOULD BE OF INTEREST TO THOSE WHO WISH A HISTORICAL, RATHER THAN TECHNICAL, DISCUSSION OF MAN-COMPUTER INTERACTION.

300 LINE PRINTER PSEUDOGRAPHICS
LING, R.F. A COMPUTER GENERATED AID FOR CLUSTER ANALYSIS. COMMUNICATIONS OF
THE ACM, 1973, 16, 355-361.
DESCRIPTION:

A COMPUTER GENERATED GRAPHIC METHOD, WHICH CAN BE USED IN CONJUNCTION WITH ANY HIERARCHICAL SCHEME OF CLUSTER ANALYSIS, IS DESCRIBED AND ILLUSTRATED. THE GRAPHIC PRINCIPLE USED IS THE REPRESENTATION OF THE ELEMENTS OF A DATA MATRIX OF SIMILARITIES OR DISSIMILARITIES BY COMPUTER PRINTED SYMBOLS (OF CHARACTER OVERSTRIKES) OF VARIOUS SHADES OF DARKNESS, WHERE A DARK SYMBOL CORRESPONDS TO A SMALL DISSIMILARITY. A WELL-KNOWN SET OF DATA CONSISTING OF THE CORRELATIONS OF 24 PSYCHOLOGICAL TESTS IS USED TO ILLUSTRATE THE COMPARISON OF GROUPINGS BY FOUR METHODS OF FACTOR ANALYSIS AND TWO METHODS OF CLUSTER ANALYSIS. (A) 7P, 14R.

COMMENTS:

THIS PAPER ILLUSTRATES A FORM OF LINE PRINTER PSEUDOGRAPHICS. SUCH DISPLAYS ARE OFTEN MORE EFFECTIVE THAN PURELY NUMERICAL DISPLAYS, ESPECIALLY WHEN THE USER'S TASK IS TO DETECT PATTERNS AND RELATIONSHIPS IN THE DATA. ALTHOUGH NO EMPIRICAL DATA ARE PRESENTED TO SUPPORT THE AUTHOR'S CONTENTION THAT THIS FORM OF DISPLAY IS EFFECTIVE, THE ILLUSTRATIONS THEMSELVES ARE A FAIRLY CONVINCING ARGUMENT. PSEUDOGRAPHIC TECHNIQUES ARE RELATIVELY LITTLE USED, BUT ARE INEXPENSIVE AND OFTEN EFFECTIVE. THIS PAPER PROVIDES SOME INFORMATION ABOUT THE TECHNIQUE, AND SHOULD INTEREST THOSE CONCERNED WITH MULTIDIMENSIONAL QUANTITATIVE DISPLAYS.

301 BIBLIOGRAPHY ON MANAGEMENT INFORMATION SYSTEMS
LOGAN, R., O'NEIL, H.F., JR., JUDD, W.A., & HARMON, E.G. TECHNICAL LITERATURE
REVIEW CONCERNING MANAGEMENT INFORMATION SYSTEMS (TECHNICAL REPORT AFHRL-TR74-50). BROOKS AFB, TEXAS: AIR FORCE HUMAN RESOURCES LABORATORY, MAY 1974.
(JSAS NO. MS-814)

THE PRIMARY OBJECTIVE OF THE LITERATURE REVIEW WAS TO OBTAIN SOURCES OF INFORMATION RELEVANT TO THE FEASIBILITY AND UTILITY OF AN ON-LINE DATA MANAGEMENT SYSTEM IN SUPPORT OF THE MANAGEMENT AND PLANNING EFFORT IN THE RESEARCH AND DEVELOPMENT ENVIRONMENT OF THE AIR FORCE HUMAN RESOURCES LABORATORY. THE FORMAL DOCUMENTATION OF THE TECHNICAL LITERATURE REVIEWED RESULTED IN AN ANNOTATED BIBLIOGRAPHY OF 112 REFERENCES. THE INTENDED AUDIENCE FOR THE BIBLIOGRAPHY WAS MIDDLE- AND UPPER-LEVEL MANAGEMENT PERSONNEL. DOCUMENTS WERE SELECTED THAT WOULD FAMILIARIZE SUCH PERSONNEL WITH THE CONTEXT AND INTERRELATIONSHIPS OF THE MANY ASPECTS OF MANAGEMENT INFORMATION SYSTEMS; THAT IS, WITH HOW ANALYSIS, DESIGN, OPERATION, EVALUATION, AND USER CONSIDERATIONS AFFECT MANAGEMENT INFORMATION SYSTEMS.

(A)
41P, 112R.

COMMENTS:

THIS PAPER PROVIDES A GOOD SOURCE OF REFERENCES FOR THOSE INTERESTED IN MANAGEMENT INFORMATION SYSTEMS. ALTHOUGH THE AUTHORS ACCURATELY SUMMARIZE THE CONTENT OF THE ARTICLES REVIEWED, THEIR ANNOTATIONS ARE NOT CRITICAL AND THEY DO NOT ATTEMPT TO INTEGRATE THIS LITERATURE. THE READER OF THIS REVIEW, THEREFORE, WOULD MEED TO REFER TO THE ACTUAL ARTICLES IN ORDER TO DETERMINE THE VALIDITY OF THEIR CONTENT. NEVERTHELESS, THIS REVIEW DOES INDICATE RESEARCH DIRECTIONS, PROCEDURES, AND METHODOLOGIES IN MANAGEMENT INFORMATION SYSTEMS.

302 INFORMATION RETRIEVAL SYSTEMS
LOWE, T.C. DESIGN PRINCIPLES FOR AN ON-LINE INFORMATION RETRIEVAL SYSTEM
(TECHNICAL REPORT NO. 67-14). PHILADELPHIA, PENNSYLVANIA: UNIVERSITY OF
PENNSYLVANIA, MOORE SCHOOL OF ELECTRICAL ENGINEERING, DECEMBER 1966. (NTIS NO. AD 647196)
DESCRIPTION:

AREAS INVESTIGATED INCLUDE A SLOW MEMORY DATA STORAGE, THE PROBLEM OF DECODING FROM AN INDEX TO A SLOW MEMORY ADDRESS, THE STRUCTURE OF DATA LISTS AND DATA LIST OPERATORS, COMMUNICATIONS BETWEEN THE HUMAN USER AND THE SYSTEM, PROCESSING OF RETRIEVAL REQUESTS, AND THE USER'S CONTROL OVER THE RETURN OF INFORMATION RETRIEVED.

LINEAR, LINKED AND INVERTED FILE STRUCTURES ARE CONSIDERED. EMPIRICAL DATA FROM THE REPOSITORY OF THE ASSOCIATION FOR COMPUTING MACHINERY ARE USED FOR ILLUSTRATIVE PURPOSES. THESE DATA ARE ALSO USED IN THE PORTION OF THE DECODING NECHANISM STUDY WHICH DEALS WITH THE EFFECTS OF TRUNCATION OF INDEX TERMS.

FOLLOWING THE FILE ORGANIZATION STUDY, THE NECESSARY LIST STRUCTURES AND LIST OPERATORS ARE DESIGNED. AN EDITING LANGUAGE FOR USE BY THE HUMAN OPERATOR IN COMMUNICATING WITH THE SYSTEM IS SPECIFIED, AS ARE THE REQUIREMENTS FOR THE EXECUTION OF "BACKGROUND" PROGRAMS WHEN A USER'S INFORMATION RETRIEVAL REQUEST IS NOT BEING PROCESSED. FINALLY, A SIMPLE SEQUENCE OF MAN-MACHINE COMMUNICATIONS WHICH ALLOW THE USER OF THE SYSTEM TO SPECIFY WHAT CLASSES OF DATA ARE TO BE RETURNED TO HIM IS OUTLINED. (A) 121P, 26R.

THIS PAPER PRESENTS A DETAILED DISCUSSION OF HARDWARE AND SOFTWARE CONSIDERATIONS IN DESIGNING AN INFORMATION RETRIEVAL SYSTEM TO OPERATE WITH A LARGE DATA BASE AND DESCRIBES A SPECIFIC SYSTEM. THE EMPHASIS IS ON WHAT A COMPUTER SYSTEM CAN DO RATHER THAN ON WHAT IT SHOULD DO TO AID THE HUMAN USER. ALTHOUGH THE DISCUSSION OF HARDWARE AND SOFTWARE LIMITATIONS IS SOMEWHAT DATED, THIS PAPER MAY BE OF INTEREST TO THOSE CONCERNED WITH THE MACHINE SIDE OF AN INTERACTIVE INFORMATION RETRIEVAL INTERFACE.

303 USER ACCEPTANCE OF AUTOMATED MEDICAL HISTORY SYSTEM LUCAS, R.W. A STUDY OF PATIENTS ATTITUDES TO COMPUTER INTERRUGATION. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1977, 9, 69-86. DESCRIPTION:

IN THE EVALUATION OF TECHNIQUES FOR THE AUTOMATIC ACQUISITION OF MEDICAL HISTORY DATA, THE ATTITUDES OF PATIENTS, THE "USERS", ARE OF THE UTMOST IMPORTANCE. WHILE PATIENTS' OPINIONS HAVE BEEN SOUGHT IN SEVERAL STUDIES, THERE HAS PREVIOUSLY BEEN NO OBJECTIVE MEASUREMENT OF ATTITUDES IN THIS FIELD.

IN THE PRESENT PAPER, THE DEVELOPMENT AND EVALUATION OF TWO SCALES FOR THE MEASUREMENT OF PATIENTS' ATTITUDES ARE DESCRIBED, ONE BEING OF THE TRADITIONAL "THURSTONE" TYPE BASED ON ATTITUDE STATEMENTS, AND THE OTHER BEING A SEMANTIC DIFFERENTIAL SCALE. A RELIABILITY COEFFICIENT OF 0.90 WAS OBTAINED FOR THE "THURSTONE" SCALE, AND THE RESULTS FROM THIS AND THE SEMANTIC DIFFERENTIAL WERE FOUND TO CORRELATE HELL WITH EACH OTHER (R=0.70), SUPPORTING THE VALIDITY OF THE MEASURES.

IN A STUDY OF 75 PATIENTS, EACH WAS INTERROGATED BY COMPUTER AND THEN ASKED TO TAKE HOME A QUESTIONNAIRE CONTAINING THE ATTITUDE SCALES TO COMPLETE AND RETURN ANONYMOUSLY THROUGH THE POST. OF THE 67 PATIENTS WHO RETURNED THEIR QUESTIONNAIRES, 82% HAD FAVOURABLE ATTITUDES TOWARD COMPUTER INTERROGATION, AND 49% HAD MORE FAVOURABLE ATTITUDES TOWARD MEDICAL INTERVIEWS WITH A COMPUTER THAN TOWARD MEDICAL INTERVIEWS WITH A DOCTOR. MALE PATIENTS HAD MORE FAVOURABLE ATTITUDES THAN FEMALE PATIENTS; YOUNGER PATIENTS WERE MORE FAVOURABLE TOWARD THE COMPUTER THAN OLDER PATIENTS; AND MANUAL WORKERS WERE MORE FAVOURABLE TOWARD THE COMPUTER THAN NON-MANUAL WORKERS. (A) 18P, 42R.

## COMMENTS:

THIS PAPER PRESENTS AN EMPIRICAL EVALUATION OF A SIMPLE QUESTION-AND-ANSWER DIALOGUE FOR USE IN AUTOMATED MEDICAL INTERVIEWS. THE PRIMARY EMPHASIS IS ON TECHNIQUES TO OBJECTIVELY EVALUATE PATIENTS' ATTITUDES TOWARD AUTOMATED INTERVIEWS AND TWO TECHNIQUES ARE DESCRIBED IN SOME DETAIL AND COMPARED AND CONTRASTED. IN GENERAL, PATIENT ACCEPTANCE WAS VERY HIGH. IN VIEW OF THE RELATIVELY SIMPLE DIALOGUE USED, THIS SUGGESTS THAT FURTHER DEVELOPMENTS OF THIS DIALOGUE COULD LEAD TO EVEN GREATER ACCEPTANCE AND FAVORABLE ATTITUDES. THE ATTITUDE DIFFERENCES ATTRIBUTED TO SEX, AGE, AND OCCUPATION ARE HIGHLY SIGNIFICANT, AND IT SEMS LIKELY THAT SUCH DIFFERENCES APPLY TO A WIDE RANGE OF INTERACTIVE SYSTEMS, RATHER THAN ONLY TO THE MEDICAL INTERVIEW SYSTEM DESCRIBED HERE.

304 GENERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
LUCIER, R.O., & PARKER, E.J. HUMAN FACTORS CONSIDERATIONS IN THE DESIGN OF
ELECTRONIC COMPUTERS: FINAL REPORT (REPORT NO. ADGOURT). PHILADELPHIA,
PENNSYLVANIA: UNIVERSITY OF PENNSYLVANIA, MOORE SCHOOL OF ELECTRICAL
ENGINEERING, JUNE 1960.
DESCRIPTION:

THE MAIN TEXT OF THIS REPORT IS DIVIDED INTO THREE SECTIONS, WHICH ARE CONCERNED WITH THE DESIGN OF OPERATORS' CONSOLES, THE USE OF HUMAN FACTORS BY PRODUCERS OF ELECTRONIC COMPUTERS, AND THE CONSIDERATION OF THE HUMAN COMPONENT OF MAN-MACHINE RELATIONSHIPS IN THE AREA OF ADPS. SEVERAL ARGUMENTS ARE PUT FORTH, ONE OF WHICH IS THE NEED TO STANDARDIZE VARIOUS ASPECTS OF DESIGN IN THE CONTROL PANELS OF CONSOLES. ANOTHER FACT THAT THE AUTHOR POINTS OUT IS THE PROBLEM OF ADP PERSONNEL -- THE GROWING NEED FOR PROGRAMMERS AND THE DWINDLING SOURCE OF MANPOWER, THE HIGH PRODUCTION OF COMPUTERS AND THE INABILITY TO FIND ENOUGH PERSONNEL TO HANDLE THEM.

PROGRAMMERS AND THE DWINDLING SOURCE OF MANPOWER, THE HIGH PRODUCTION OF COMPUTERS AND THE INABILITY TO FIND ENOUGH PERSONNEL TO HANDLE THEM.

THE APPENDIX OF THE REPORT IS CONCERNED WITH VARIOUS APTITUDE AND PSYCHOLOGICAL TESTS ADMINISTERED TO PEOPLE IN ADPS. IT DISCUSSES AND COMPARES THE TESTS AND THE RESULTS OF SUCH TESTS. (A, ABBR.)

53P, 8R.

COMMENTS:

THE FIRST TWO SECTIONS OF THIS REPORT ARE EXTREMELY BRIEF AND STATE, IN ESSENCE, THAT OPERATOR'S PANELS SHOULD BE STANDARDIZED AND HUMAN FACTORS PERSONNEL SHOULD BE INVOLVED IN THEIR DESIGN. THE MAIN SECTION OF THIS REPORT DESCRIBES THE RESULTS OF A STUDY IN WHICH APTITUDE AND PSYCHOLOGICAL TESTS WERE ADMINISTERED TO FOUR GROUPS OF SUBJECTS. THREE GROUPS OF SUBJECTS WERE STUDENTS IN PROGRAMMING COURSES AND THE FOURTH GROUP HAD A MINIMUM OF ONE YEAR OF PRACTICAL EXPERIENCE. ALTHOUGH PERFORMANCE MEASURES ARE PRESENTED FOR THEE OF THE GROUPS, A DIFFERENT MESURE IS USED FOR EACH FORDUP AND THE PRIMARY ANALYSIS CONSISTS OF CORRELATIONS BETWEEN THE VARIOUS TESTS ADMINISTERED. SINCE ONLY ONE TEST WAS GIVEN TO ALL GROUPS, THE DISCUSSION OF GROUP DIFFERENCES IS NOT PARTICULARLY MEANINGFUL. IN FACT, THIS SINGLE TEST, THAT WAS APPARENTLY DEVISED BY ONE OF THE AUTHORS, DOES NOT APPEAR TO BE CONSISTENTLY RELATED TO PERFORMANCE MEASURES. EXCEPT FOR THE INTERCORRELATIONS BETWEEN THE VARIOUS TESTS USED, THIS PAPER PROVIDES LITTLE USEFUL INFORMATION.

305 MAN-COMPUTER PROBLEM SOLVING
LUMSDAINE, A.A., HUNT, E., BEACH, L.R., PAGANO, R.R., & WELLS, H.H. LEARNING
AND OPTIMIZATION OF COGNITIVE CAPABILITIES (TECHNICAL REPORT AFOSR 70-2761TR).
SEATTLE, WASHINGTON: UNIVERSITY OF WASHINGTON, DEPARTMENT OF PSYCHOLOGY,
JUNE 1970. (NTIS NO. AD 716459)
DESCRIPTION:

THIS REPORT SUMMARIZES BRIEFLY THE WORK OF A THREE-YEAR SERIES OF EXPERIMENTAL STUDIES OF HUMAN COGNITION, INVOLVING THE INVESTIGATION OF PROBLEM SOLVING AND LEARNING IN MAN-MACHINE INTERACTION SITUATIONS, AND OF VARIABLES AND PROCESSES RELEVANT IN SUCH SITUATIONS. THE WORK INCLUDED FOUR SEPARATE PROJECTS: (1) COMPUTER—AIDED PROBLEM SOLVING, DEALT WITH THE QUESTION OF HOW ADVANCED TECHNIQUES IN COMPUTER SCIENCE CAN BE USED TO AID HUMANS IN SYMBOLIC AS WELL AS NUMERICAL PROBLEM—SOLVING, OF TYPES RELEVANT IN COLLATING AND INTERPRETING INTELLIGENCE DATA, (2) COMPUTER—AIDED INSTRUCTION TECHNIQUES, WAS CONCERNED WITH THE EFFECTIVENESS AND EFFICIENCY OF DIFFERENT STRATEGIES WHICH CAN BE USED IN COMPUTER CONTROLLED INSTRUCTION, RELEVANT TO THE DESIGN OF INSTRUCTIONAL SYSTEMS APPLICABLE IN MANY ASPECTS OF AIR FORCE TRAINING, (3) FEEDBACK IN CONCEPT LEARNING, WAS CONCERNED WITH VARIABLES WHICH CONTROL THE ABILITY OF HUMANS TO LEARN CONCEPTUAL CLASSIFICATIONS, (4) INTUITIVE DECISION MAKING, INVESTIGATED HUMAN CAPACITIES FOR MAKING UNAIDED JUDGEMENTS ABOUT THE OPERATION OF SIMPLE SYSTEMS. THE LIMITS OF HUMAN CAPABILITIES FOR MAKING SUCH JUDGEMENTS CAN HELP TO DETERMINE WHEN ONE SHOULD SHIFT TO MORE ANALYTIC DECISION—MAKING TECHNIQUES. EACH OF THE FOUR PROJECTS WAS CONCERNED WITH RESEARCH TO OBTAIN KNOWLEDGE THAT COULD CONTRIBUTE TO THE EFFICIENCY OF MAN-MACHINE SYSTEMS FUNCTIONING IN MAKING DECISIONS AND PERFORMANCE OF VARIOUS RELATED KINDS OF INTELLECTUAL TASKS. (A)

COMMENTS:

THIS IS AN EXTREMELY BRIEF DISCUSSION OF A LONG-TERM RESEARCH PROJECT. THIS PAPER DOES, HOWEVER, INDICATE HOW BASIC RESEARCH IN COGNITIVE PSYCHOLOGY CAN LEAD TO USEFUL APPLICATIONS AND IT MAY BE OF INTEREST TO THOSE CONCERNED WITH THIS TOPIC. THE PAPER CITES OTHER, MORE DETAILED REPORTS FROM THE PROJECT.

306 PROBLEMS OF TIME-SHARING SYSTEMS

MACDONALD, N. A TIME-SHARED COMPUTER SYSTEM: THE DISADVANTAGES. COMPUTERS AND AUTOMATION, SEPTEMBER 1965, 14(9), 21-22. DESCRIPTION:

IN THESE DAYS, MANY PEOPLE CONSIDER A TIME-SHARED COMPUTER SYSTEM TO BE HIGHLY DESIRABLE, AND SOMETHING THAT SHOULD BE OBTAINED AS QUICKLY AS IT CAN BE AFFORDED.

WHEN ONE IS IN SUCH AN OPTIMISTIC MOOD, IT IS WORTHWHILE TO BE VERY OBJECTIVE ABOUT THE DISADVANTAGES AS WELL AS THE ADVANTAGES. IN THIS SHORT REPORT WE SHALL CONCENTRATE ON THE DISADVANTAGES, BASED LARGELY ON SOME LIMITED BUT VERY REAL EXPERIENCE. PROBABLY THERE ARE ENOUGH PEDPLE NOWADAYS CONCENTRATING ON THE ADVANTAGES. (A) 2P, OR.

COMMENTS:

THE DISADVANTAGES DISCUSSED IN THIS PAPER INCLUDE DOWN TIME (MULTIPLE USERS ARE AFFECTED), PRESSURE FOR ACCESS AND ADDITIONAL CONSOLES, ALLOCATING USER PRIORITIES, THE LACK OF HUMAN INTERACTION, COMPLEXITY, AND COST. IN THE TIME FRAME IN WHICH THIS PAPER WAS WRITTEN, SEVERAL ARTICLES FOCUSED ON THE ADVANTAGES OF TIME-SHARED SYSTEMS; THIS PAPER PROVIDES BALANCE TO THESE DISCUSSIONS. ALTHOUGH QUITE OUTDATED, THIS PAPER IS STILL INTERESTING. TIME-SHARING SYSTEMS HAVE, OF COURSE, EVOLVED CONSIDERABLY SINCE THIS PAPER WAS WRITTEN. THE DISADVANTAGES DISCUSSED IN THIS PAPER, HOWEVER, MAY STILL HAVE SOME VALIDITY.

307 TERMINAL SELECTION
MACHOVER, C. INTERACTIVE CRT TERMINAL SELECTION. SID JOURNAL, NOVEMBERDECEMBER 1972, 1(4), 10-17.
DESCRIPTION:

THIS PAPER DESCRIBES A SYSTEMATIC METHOD FOR EVALUATING VARIOUS TERMINAL-TYPES IN TERMS OF THE APPLICATION REQUIREMENTS. BRIEFLY: (A) THE VARIOUS TYPES OF COMMERCIALLY AVAILABLE TERMINALS ARE CATEGORIZED, (B) RELEVANT PERFORMANCE CHACTERISTICS ARE LISTED, AND (C) A NUMERIC VALUE IS ASSIGNED TO EACH OF THESE CHACTERISTICS FOR EACH OF THE TERMINAL CATEGORIES. THE USER THEN DECIDES: (1) WHICH OF THESE PERFORMANCE CHACTERISTICS ARE IMPORTANT FOR HIS APPLICATION, (2) WHETHER ADDITIONAL FACTORS SHOULD BE EVALUATED FOR HIS APPLICATION, AND (3) WHETHER SOME OF THE FACTORS SHOULD WEIGH MORE HEAVILY IN THE FINAL EVALUATION THAN OTHERS. (A) 8P, OR.

COMMENTS:

THIS PAPER DESCRIBES A VERY SIMPLE TECHNIQUE FOR THE SELECTION OF CRT TERMINALS FOR A GIVEN APPLICATION. THE EFFECTIVENESS OF THIS TECHNIQUE, HOWEVER, IS NOT DEMONSTRATED IN THIS PAPER. THE PERFORMANCE CHARACTERISTICS AND THE RATINGS OF THESE CHARACTERISTICS ARE BASED ON THE AUTHOR'S JUDGMENT. IN ADDITION, SEVERAL GENERIC CLASSES OF CRTS (E.G. STORAGE TUBE) ARE EVALUATED RATHER THAN SPECIFIC TYPES, WHICH CAN VARY WIDELY IN PERFORMANCE CHARACTERISTICS. THE DETERMINATION OF RELEVANT PERFORMANCE FACTORS SHOULD BE AN IMPORTANT STEP IN CRT SELECTION; IT IS NOT CLEAR, HOWEVER, THAT THE FACTORS IDENTIFIED IN THIS PAPER ARE SUFFICIENT. THIS LIST DOES PROVIDE A STARTING POINT AND MAY CALL ATTENTION TO CONSIDERATIONS OTHERWISE EASILY DVERLOOKED.

308 PROPERTIES OF COMMERCIALLY AVAILABLE DISPLAY DEVICES
MACKEY, T.A. CLASSIFICATION OF CONSULE DISPLAYS AND THEIR FUNCTIONAL
APPLICATIONS (TECHNICAL REPORT ESD-TR-69-123). BEDFORD, MASSACHUSETTS: MITRE
CORP., MAY 1969. (NTIS NO. AD 689551)
DESCRIPTION:

THIS DOCUMENT PRESENTS A SURVEY OF CONSOLE DISPLAY DEVICES AND THEIR FUNCTIONAL APPLICATIONS FOR THE USAF COMMAND AND CONTROL ENVIRONMENT. IN PARTICULAR, CONSOLE DISPLAY DEVICES WHICH ENHANCE MAN/MACHINE INTERACTION HAVE BEEN EMPHASIZED. (A)

THIS REPORT DISCUSSES THE FUNCTIONAL CHARACTERISTICS, CAPABILITIES, AND COST OF A LARGE NUMBER OF COMMERCIALLY AVAILABLE TERMINALS AND DISPLAY DEVICES OF FOUR TYPES: STATIC ALPHANUMERIC, DYNAMIC ALPHANUMERIC, STATIC GRAPHIC, AND DYNAMIC GRAPHIC.

166P. 19R.

COMMENTS:

THIS PAPER CONTAINS A VERY BRIEF DISCUSSION OF THE TYPES OF DISPLAY DEVICES AND THE APPLICATION AREAS IN WHICH DISPLAY DEVICES ARE USED. THE BULK OF THIS PAPER CONSISTS OF APPENDICES THAT PRESENT THE FUNCTIONAL CHARACTERISTICS OF SPECIFIC DISPLAY DEVICES. ALTHOUGH SOMEWHAT DATED, THIS INFORMATION MAY BE OF USE TO THOSE CONCERNED WITH TERMINAL SELECTION.

309 PROPERTIES OF DOT-MATRIX DISPLAYS

MADDOX, M.E. PREDICTION OF INFORMATION TRANSFER FROM COMPUTER-GENERATED DOT MATRIX DISPLAYS. IN PROCEEDINGS OF THE 21ST ANNUAL MEETING OF THE HUMAN FACTORS SO IETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1977, 38-42. DESCRIPTION:

TWO SEPARATE EXPERIMENTS DERIVED AND VALIDATED PREDICTIVE METRICS (OR EQUATIONS) OF INFORMATION TRANSFER FROM DOT MATRIX DISPLAYS. THE INITIAL EXPERIMENT INVOLVED THREE LEVELS OF DOT SIZE, THREE LEVELS OF DOT SHAPE, THREE LEVELS OF DOT SPACING, AND TWO LEVELS OF AMBIENT ILLUMINANCE. THE PREDICTOR VARIABLE POOL WAS OBTAINED BY FOURIER ANALYSIS OF VERTICAL AND HORIZONTAL MICROPHOTOMETRIC SCANS OF EACH EXPERIMENTAL DISPLAY COMBINATION.

MULTIPLE REGRESSION TECHNIQUES WERE USED TO DERIVE PREDICTIVE EQUATIONS FOR EACH TASK. SUBSTANTIAL PROPORTIONS OF EXPERIMENTAL VARIANCE WERE ACCOUNTED FOR BY THESE EQUATIONS. THESE PROPORTIONS RANGED FROM R-SQUARE = .47 FOR THE MENU SEARCH MODEL TO R-SQUARE = .57 FOR THE READING TASK MODEL.

AN EXTERNAL VALIDATION STUDY WAS CONDUCTED USING DOT PARAMETERS EQUIVALENT TO THREE COMMERCIALLY AVAILABLE DISPLAYS. IN ADDITION, THE MATRIX SIZE WAS VARIED IN THIS EXPERIMENT. EXCEPT FOR THE RANDOM SEARCH PERFORMANCE, THE PREDICTIONS DERIVED IN THE FIRST STUDY CORRELATED WELL WITH THE MEASURED PERFORMANCE IN THIS STUDY (SPEARMAN R = .73). THE EQUATIONS WERE FOUND TO BE VERY SENSITIVE TO PREDICTOR VARIABLES WHICH WERE OUTSIDE THE RANGE OF THE ORIGINAL REGRESSION.

THE PHOTOMETRIC SCAN AND FOURIER ANALYSIS METHODOLOGY WAS FOUND TO BE ACCURATE AND VERY REPEATABLE IN THIS RESFARCH. (A) 5P, 17R.

COMMENTS:

THE EXPERIMENTS REPORTED HERE ARE DESCRIBED ONLY VERY BRIEFLY AND THE PRIMARY EMPHASIS IS ON EQUATIONS TO RELATE DISPLAY PARAMETERS TO HUMAN PERFORMANCE. THE PRINCIPAL CONTRIBUTION OF THIS RESEARCH IS THE APPLICATION OF A METHODOLOGY FOR DEVELOPING PREDICTIVE, QUANTITATIVE RELATIONS BETWEEN HUMAN PERFORMANCE AND DISPLAY PARAMETERS. ALTHOUGH THIS METHODOLOGY IS EXTREMELY GENERAL AND STRAIGHTFORWARD, IT REQUIRES THE SPECIFICATION OF APPROPRIATE PREDICTOR VARIABLES TO DESCRIBE RELEVANT SYSTEM PARAMETERS. FOR MANY TYPES OF SITUATIONS (E.G., MAN-COMPUTER DIALOGUE), THIS IS A NON-TRIVIAL TASK AND APPEARS TO REQUIRE EMPIRICAL VALIDATIONS OF POTENTIAL PREDICTOR VARIABLES. THIS APPEARS TO BE A NECESSARY STEP, HOWEVER, IF QUANTITATIVE GUIDELINES ARE TO BE DEVELOPED.

310 MAN-COMPUTER TASK ALLOCATION

MANDELBAUM, J., JORGENSEN, E.L., SMITH, D.E., & STORCK, C.E. MAN-MACHINE ROLE IDENTIFICATION IN SEEKING IMPROVED SOLUTIONS TO LARGE-SCALE COMPUTER SIMULATION PROBLEMS (REPORT NO. NSRDC-4244). BETHESDA, MARYLAND: NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, AUGUST 1973. (NTIS NO. AD 770129) DESCRIPTION:

THIS PAPER DESCRIBES INSIGHTS, PROCEDURES, AND LIMITATIONS INVOLVED IN THE SEMI-AUTOMATIC SOLUTION OF LARGE-SCALE COMPUTER SIMULATION PROBLEMS. IT UTILIZES THE EXPERIENCE GAINED IN SOLVING TEST PROBLEMS BY BOTH A HUMAN AMALYST AND AN AUTOMATIC OPTIMIZER PROGRAM. PARTICULAR ATTENTION IS PAID TO THOSE TASKS PERFORMED BY THE MAN BUT NOT THE MACHINE AND THOSE TASKS BEST DONE BY THE MACHINE. GUIDELINES ARE SUGGESTED FOR INCORPORATING SOME OF THE HUMAN PROBLEM-SOLVING PROCESSING AS A FIRST STEP TOWARD INTERACTIVE SEMI-AUTOMATIC PROCEDURES. (A) 29P, 8R.

COMMENTS:

THE EXPERIMENTAL TASK USED IN THIS RESEARCH IS THE ALLOCATION OF A DESTROYER TASK FORCE TO INCREASE THE PROBABILITY OF DETECTING ENEMY SUBMARINES. THE AUTHORS' OBSERVATIONS ARE BASED ON A SINGLE EXPERIMENTAL SUBJECT. THIS TASK IS VIEWED, CORRECTLY, AS A SEARCH TASK; A SUBJECT GENERATES A POSSIBLE PROBLEM CONFIGURATION AND THEN EVALUATES IT WITH RESPECT TO OPTIMUM RESULTS. THE SEARCH SPACE IS, OF COURSE, QUITE LARGE. IN SUCH TASKS, A HUMAN PROBLEM SOLVER RARELY RESORTS TO A BLIND TRIAL-AND-ERROR SEARCH; RATHER, HE EMPLOYS HEURISTICS TO REDUCE THE SIZE OF THE SEARCH SPACE. THIS IS ESSENTIALLY THE RESULT REPORTED BY THE AUTHORS. AN AUTOMATED PROBLEM SOLVER IS MUCH BETTER AT THE MECHANICS OF SEARCH AND EVALUATION. IT IS SUGGESTED IN THIS PAPER THAT A MAN-MACHINE PROBLEM SOLVING SYSTEM UTILIZE THE HEURISTICS OF THE HUMAN PROBLEM SOLVER TO GUIDE THE MACHINE'S RAPID SEARCH PROCEDURES. THIS IS QUITE REASONAMLE, AND IT HAS BEEN FREQUENTLY SUGGESTED BY OTHERS. UNDERSTANDING THE HEURISTICS EMPLOYED BY A HUMAN PROBLEM SOLVER IS A VERY DIFFICULT TASK AND AUTOMATION WOULD BE EXTREMELY DIFFICULT. INTERACTIVE PROBLEM SOLVING EXPLOITS THE POWER OF THESE HEURISTICS WITHOUT THE REQUIREMENT OF FULLY UNDERSTANDING THEM.

#### MAN-COMPUTER DIALOGUE 311

MANN, W.C. DIALOGUE-BASED RESEARCH IN MAN-MACHINE COMMUNICATION (TECHNICAL REPORT ISI/RR-75-41). MARINA DEL REY, CALIFORNIA: UNIVERSITY OF SOUTHERN CALIFORNIA, INFORMATION SCIENCES INSTITUTE, NOVEMBER 1975 (ALSO IN PRESS, INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES).

THIS PAPER SURVEYS CURRENT KNOWLEDGE OF HUMAN COMMUNICATION FROM A POINT OF VIEW WHICH SEEKS TO FIND OR DEVELOP KNOWLEDGE THAT WILL BE USEFUL TO COMPUTER SYSTEM DESIGNERS. THE RELEVANT SCIENTIFIC KNOWLEDGE IS FOUND TO BE FRAGMENTARY AND HARD FOR DESIGNERS TO USE.

MEXT, THE PROBLEM OF COMPLEXITY IS EXPLORED. BUILDING A USEFUL KNOWLEDGE OF HUMAN COMMUNICATION IS AN EXTREMELY COMPLEX TASK. CONTROLLING THIS COMPLEXITY AND ITS EFFECTS, WITHOUT GIVING UP USEFULNESS, IS SEEN AS THE CENTRAL PROBLEM IN DESIGNING A RESEARCH APPROACH.

FINALLY, A NEW RESEARCH METHODOLOGY IS PRESENTED. IT CONTAINS SOME INNOVATIONS THAT HELP CONTROL THE COMPLEXITY OF THE TASK, AND OTHERS THAT MAKE THE RESULTS USEFUL TO DESIGNERS. THE METHODOLOGY IS UNIQUE IN THAT IT IS RESED ON CASE ANALYSIS PATHER THAN FUNCTIONAL SYSTEM DESIGN. THE PESSULTS

IS BASED ON CASE ANALYSIS RATHER THAN FUNCTIONAL SYSTEM DESIGN, THE RESULTS ARE IN THE FORM OF INDIVIDUAL COMPUTER ALGORITHMS (MUCH SMALLER THAN SYSTEMS), AND THE ALGORITHMS ARE TRANSFERABLE INTO USEFUL (NONRESEARCH) SYSTEMS.

THIS RESEARCH IS AN INTEGRAL PART OF A LARGER SET OF RESEARCH OBJECTIVES TO SUBSTANTIALLY IMPROVE MAN/MACHINE COMMUNICATION -- PARTICULARLY FOR THE GROWING LEVEL OF ON-OLINE, INTERACTIVE USE OF COMPUTERS BY THE DEPARTMENT OF DEFENSE AND THE MILITARY DEPARTMENTS. (A)

## COMMENTS:

THE METHODOLOGY DESCRIBED IN THIS PAPER CENTERS ON IDENTIFYING "KEY COMMUNICATION PHENOMENA" IN INTERPERSONAL DIALOGUES AND DEVELOPING A SIMULATION MODEL THAT CAN ACCOUNT FOR THESE PHENOMENA. THESE "KEY PHENOMENA" ARE NOT DESCRIBED IN SUFFICIENT DETAIL TO BE USEFUL TO THE CASUAL READER WHO MIGHT WISH TO APPLY THIS METHODOLOGY AND THE LIST OF PHENOMENA PRESENTED MAY NOT BE EXHAUSTIVE OF ALL RELEVANT ASPECTS OF DIALOGUES. SIMILARLY, THE TYPE OF MODEL THAT WOULD BE REQUIRED TO SIMULATE INTERPERSONAL, OR MAN-COMPUTER, DIALOGUES IS NOT ADEQUATELY DESCRIBED. THIS IS A PRELIMINARY PAPER, HOWEVER, AND THE METHODOLOGY PROPOSED HERE IS CERTAINLY WORTH CONSIDERING AND MAY PROVE TO BE VERY USEFUL.

#### 312 ORGANIZATIONAL IMPACT OF COMPUTERS

MARGULIES, F. EVALUATING MAN-COMPUTER SYSTEMS. PAPER PRESENTED AT NATO ADVANCED STUDY INSTITUTE ON MAN-COMPUTER INTERACTION, MATI, GREECE, SEPTEMBER 1976 (REPRINTED BY AUSTRIAN FEDERATION OF TRADE UNIONS, VIENNA, AUSTRIA). DESCRIPTION:

THIS PAPER ARGUES THAT, LIKE MANY MACHINES, COMPUTERS HAVE A STRONG POTENTIAL FOR DEHUMANIZING AND DEMOTIVATING EMPLOYEES, WITH A RESULTANT LOSS TO BOTH THE EMPLOYEE AND EMPLOYER. IT IS THE AUTHOR'S THESIS THAT GREATER EMPLOYEE INVOLVEMENT IN THE DECISIONS AND DESIGN PROCESSES ASSOCIATED WITH COMPUTER SYSTEMS AND IN THE DESIGN OF COMPUTER-RELATED JOBS CAN HELP FORESTALL THESE NEGATIVE EFFECTS.

## 19P, 12R. COMMENTS:

THE AUTHOR OF THIS PAPER PEPRESENTS A FEDERATION OF TRADE UNIONS. IT SHOWS. WHILE THE CONCERNS EXPRESSED IN THE PAPER CAN BE QUITE REAL AND SIGNIFICANT, THE PAPER HAS A STROOG FLAVOR OF MANAGEMENT-UNION NEGOTIATION, AND FAILS TO MAKE ANY MATERIAL SUGG STIONS FOR AVOIDING THESE PROBLEMS. IT IS TO BE ASSUMED THAT THE PAPER WAS INTENDED TO INFLUENCE THOSE WHO MIGHT BE ABLE TO PROVIDE SUCH SUGGESTIONS. READERS OF A HUMANISTIC BENT WILL UNDOUBTEDLY SYMPATHIZE WITH THE AUTHOR'S GOAL, BUT WILL PROBABLY FIND FEW NEW IDEAS

# 313 COMPUTER GRAPHICS

MARKS, J.A. COMPUTER GRAPHICS: HUMANIZING THE DATA EXPLOSION. ELECTRIC LIGHT AND POWER, 1970, 48, 57-64.

### DESCRIPTION:

A COMPUTER IS CAPABLE OF GENERATING A LARGE AMOUNT OF INFORMATION. EVEN THOUGH A MACHINE CAN BE PROGRAMMED TO FILTER OUT SOME TRIVIAL FACTS, THE AMOUNT OF INFORMATION PRESENTED IS OFTEN MORE THAN THE HUMAN CAN COPE WITH. WHAT IS NEEDED IS A CONVENIENT METHOD FOR INTERPRETING ALL OF THESE DATA. COMPUTER DRIVEN GRAPHICS TERMINALS SATISFY THIS NEED. THIS PAPER SUMMARIZES THE BASIC TYPES OF GRAPHICS TERMINALS AVAILABLE AS WELL AS THEIR COSTS, ABILITIES AND LIMITATIONS.

8P, OR.

# COMMENTS:

THIS IS A GENERAL, NON-TECHNICAL DISCUSSION OF THE USE OF COMPUTER GRAPHICS. ALTHOUGH BRIEF, THIS PAPER DOES ADDRESS A REAL PROBLEM. A COMPUTER SYSTEM CAN BE USED TO STORE AND PRESENT LARGE QUANTITIES OF INFORMATION. GRAPHIC DEVICES CAN BE USED TO CONDENSE AND PRESENT THIS INFORMATION IN A MORE EASILY UNDERSTOOD FORM. THE AUTHOR REVIEWS THE TYPES, APPLICATIONS, AND RELATIVE COSTS OF COMPUTER GRAPHICS TERMINALS. THIS PAPER WOULD BE OF INTEREST PRIMARILY TO MANAGERS WHO ARE CONSIDERING THE PURCHASE OF SOME TYPE OF GRAPHIC DEVICE.

## 314 MAN-COMPUTER DIALOGUE

MARTIN, J. DESIGN OF MAN-COMPUTER DIALOGUES. ENGLEWOOD CLIFFS, NEW JERSEY: PRENTICE-HALL, 1973.

## DESCRIPTION:

THIS IS A GENERAL TEXTBOOK ON MAN-COMPUTER DIALOGUE DESIGN. IT DISCUSSES RELEVANT OPERATOR PROPERTIES IN SOME DETAIL, AND DESCRIBES, WITH MANY ILLUSTRATIONS, A BROAD RANGE OF DIALOGUE TYPES. INCLUDED ARE DISCUSSIONS OF NATURAL-LANGUAGE DIALOGUE, PROGRAMMING LANGUAGE DIALOGUE, A WIDE RANGE OF ALPHANUMERIC AND INTERACTIVE GRAPHICAL DIALOGUES, AND VOICE ANSWERBACK. A NUMBER OF PSYCHOLOGICAL FACTORS ARE DISCUSSED, WITH SEPARATE CHAPTERS DEVOTED TO RESPONSE TIME, CHANNEL CAPACITY AND MEMORY LIMITATIONS AND DISPLAY CODING. THE EFFECTS OF OPERATOR TRAINING, EXPERIENCE, AND INTELLIGENCE ON DIALOGUE DESIGN ARE DISCUSSED IN CONSIDERABLE DETAIL. ERROR HANDLING AND A VARIETY OF IMPLEMENTATION CONSIDERATIONS ARE ALSO TREATED. 559P, 86R.

# COMMENTS:

THIS IS AN EXCELLENT BOOK. ALTHOUGH IT IS WRITTEN AT THE LEVEL OF AN INTRODUCTORY TEXTBOOK, IT SHOULD ALSO INTEREST READERS WITH CONSIDERABLE EXPERIENCE IN THE FIELD. THE BOOK IS HIGHLY READABLE AND VERY WELL ILLUSTRATED. ITS TREATMENT OF DIALOGUE TYPES IS QUITE BROAD, TOUCHING ON A LARGE VARIETY OF DIALOGUE TECHNIQUES. THE AUTHOR PROVIDES AN EXCELLENT INTRODUCTION TO DIALOGUE PROPERTIES AND THEIR RELATIONSHIP TO USER PROPERTIES (TRAINING, INTELLIGENCE, ETC.). THE EFFECTS OF TASK PROPERTIES ON DIALOGUE DESIGN ARE DISCUSSED LESS COMPLETELY. THE PSYCHOLOGICAL DISCUSSION IS REASONABLY COMPETENT AND SOMEWHAT MORE DETAILED THAN HAS BEEN TYPICAL FOR BOOKS INTENDED FOR CONSUMPTION BY THE COMPUTER SCIENCE COMMUNITY.

ANNUAL REVIEW ON MAN-COMPUTER INTERACTION

MARTIN, T.H. THE USER INTERFACE IN INTERACTIVE SYSTEMS. IN C.A. CUADRA & A.W. LUKE (EDS.), ANNUAL REVIEW OF INFORMATION SCIENCE AND TECHNOLOGY (VOL. 8). WASHINGTON, D.C.: AMERICAN SOCIETY FOR INFORMATION SCIENCE, 1973, 203-219. DESCRIPTION:

THIS PAPER FOCUSES PRIMARILY ON THE CONCEPTUAL ASPECTS OF INTERACTION. A REVIEW OF THE 1972 LITERATURE DEALING WITH INTERACTIVE SEARCH AND PLANNING IS PRESENTED AS WELL AS A DESCRIPTION OF HOW RESEARCHERS ARE USING THE THEORY/LITERATURE INTERFACE. SUGGESTED DEVELOPMENTS INCLUDE MORE EFFECTIVE INSTRUCTION AND BETTER COMMUNICATION AMONG RESEARCHERS. 17P. 68R.

COMMENTS:

EARLIER "ANNUAL REVIEW" CHAPTERS ON MAN-COMPUTER INTERACTION FOCUSED PRIMARILY ON INTERACTIVE PROGRAMMING, SOFTWARE TECHNIQUES, AND HARDWARE ASPECTS OF THE INTERFACE. THE PREVIOUS REVIEW (J.L. BENNETT, 1972)
DEPARTED FROM THIS TRADITION AND FOCUSED ON THE HUMAN SIDE OF THE INTERFACE. THE CURRENT REVIEW ALSO DEPARTS FROM THE MORE TRADITIONAL TOPICS AND FOCUSES ON THE CONCEPTUAL ASPECTS OF INTERACTION. A PRINCIPAL POINT THAT EMERGES FROM THIS REVIEW IS THAT INTERFACE RESEARCH AND DESIGN IS NOT GUIDED BY THEORY. THIS PROBLEM IS, OF COURSE, NOT UNIQUE TO MAN-COMPUTER INTERACTION SINCE ALMOST ALL AREAS OF COMPUTER SYSTEM RESEARCH SUFFER FROM THE LACK OF A COMPREHENSIVE, WELL-UNDERSTOOD THEORETICAL FRAMEWORK. THIS, AND OTHER ANNUAL REVIEWS, WOULD BE USEFUL TO ANYONE WISHING AN INTRODUCTION TO THE AREA OF MAN-COMPUTER INTERACTION OR THOSE INTERESTED IN TRACING THE DEVELOPMENT OF ISSUES AND VIEWPOINTS IN THIS AREA.

BIBLIOGRAPHIC SEARCH SYSTEMS

MARTIN, T.H., CARLISLE, J., & TREU, S. THE USER INTERFACE FOR INTERACTIVE BIBLIOGRAPHIC SEARCHING: AN ANALYSIS OF THE ATTITUDES OF NINETEEN INFORMATION SCIENTISTS. JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE, 1973, 24, 142-147.

DESCRIPTION:

SINCE LITTLE SUBSTANTIATED EVIDENCE EXISTS CONCERNING THE FEATURES THAT SHOULD OR SHOULD NOT BE INCLUDED IN THE MAN-MACHINE INTERFACE OF INTERACTIVE BIBLIOGRAPHIC SEARCH AND RETRIEVAL (IBSR) SYSTEMS, AN INFORMAL SURVEY TAPPING THE OPINIONS OF SCIENTISTS ACTIVE IN THIS RESEARCH AREA WAS AN ANALYSIS OF THE RESPONSES SHOWED A SIGNIFICANT LEVEL OF CONDUCTED. AGREEMENT CONCERNING INTERFACE FEATURES. (A) 6P, ZR.

COMMENTS:

THIS IS A VERY READABLE DISCUSSION OF THE PROPERTIES THAT AN INTERACTIVE BIBLIOGRAPHIC SEARCH AND RETRIEVAL SYSTEM SHOULD POSSESS. IT SHOULD BE NOTED, HOWEVER, THAT THIS DISCUSSION IS BASED ON THE OPINIONS OF SYSTEM DESIGNERS AND ADMINISTRATORS RATHER THAN ON THE OPINIONS OF USERS. AUTHORS ARGUE THAT THIS IS ACCEPTABLE SINCE CONTROLLED RESEARCH AND VALID POLLS OF USERS ARE BOTH VERY DIFFICULT. WHILE THIS MAY BE TRUE, ONE MUST KEEP IN MIND THAT A BIASED PERCEPTION OF USER NEEDS MAY RESULT, BOTH FROM THE USE OF ATTITUDE RATHER THAN PERFORMANCE DATA, AND FROM THE POLLING OF RESEARCHERS RATHER THAN USERS.

317 DESIGN OF INTERACTIVE BIBLIOGRAPHIC SEARCH SYSTEMS
MARTIN, T.H., & PARKER, E.B. DESIGNING FOR USER ACCEPTANCE OF AN INTERACTIVE
BIBLIOGRAPHIC SEARCH FACILITY. IN D.E. WALKER (ED.), INTERACTIVE
BIBLIOGRAPHIC SEARCH: THE USER/COMPUTER INTERFACE. MONTVALE, NEW JERSEY:
AFIPS PRESS, 1971, 45-32.
DESCRIPTION:

IN THIS PAPER SUGGESTIONS HAVE BEEN MADE TO THE DESIGNER WHO WISHES TO BUILD AN INTERACTIVE SEARCH AND RETRIEVAL SYSTEM INTENDED FOR A NONCAPTIVE USER POPULATION. IN-DEPTH INTERVIEWING AND USER PROFILES ARE SUGGESTED AS METHODS THAT WILL GIVE THE USER A VOICE IN THE DESIGN PROCESS. FLEXIBLE, MODULAR DESIGN THAT PERMITS GRADUAL PROGRESSION FROM TEST IMPLEMENTATION TO OPERATIONAL STATUS HAS BEEN RECOMMENDED. THE TEST VERSIONS ARE USED NOT ONLY TO INCREASE THE PRECISION OF THE PROFILE PREDICTIONS, BUT ALSO TO INCREASE THE COMFORT OF THE INTERFACE AND TO EVALUATE DESIGN ALTERNATIVES. WHEN THE SYSTEM IS FINALLY IN OPERATION, THE METHODS USED IN DESIGNING THE SYSTEM CAN BE USED TO COLLECT NEW DATA THAT, WHEN COMPARED WITH EARLIER DATA, MAKES IT POSSIBLE TO EVALUATE THE SUCCESS OF THE SYSTEM IN ATTRACTING ITS TARGET POPULATION. (A)

COMMENTS:

THIS PAPER PRESENTS SEVEN GUIDELINES FOR THE DESIGN OF INTERACTIVE SYSTEMS. THE AUTHOR CORRECTLY ASSUMES THAT MOST INTERACTIVE SYSTEM FAILURES ARE NOT DUE TO POOR IMPLEMENTATION, BUT RATHER TO IMAPPROPRIATE DESIGN. IT IS ALSO NOTED THAT IT IS IMPRACTICAL TO EXPECT THE POTENTIAL USER TO SPECIFY SYSTEM SPECIFICATIONS WITHOUT PROVIDING HIM SOME PROTOTYPE SYSTEM THAT HE CAN EVALUATE. THE PROPOSED GUIDELINES ARE CONCERNED WITH DESIGNING A FLEXIBLE SYSTEM THAT CAN BE USED TO DETERMINE USER REQUIREMENTS. AND THAT CAN EASILY BE MODIFIED TO MEET THESE REQUIREMENTS. THESE GUIDELINES ARE CLEARLY PRESENTED AND SHOULD BE RELATIVELY EASY TO IMPLEMENT.

318 COMPARISON OF TERMINAL TYPES
MARTIN, W.L., & CHUBB, G.P. HUMAN ENGINEERING CONSIDERATIONS IN DESIGNING
INTERACTIVE GRAPHIC DISPLAYS FOR LOGISTICS MANAGEMENT. PAPER PRESENTED AT
MEETING OF THE HUMAN FACTORS SOCIETY, SAN FRANCISCO, OCTOBER 1970 (REPRINTED BY
AEROSPACE MEDICAL RESEARCH LABORATORY, WRIGHT-PATTERSON AFB, OHIO).
DESCRIPTION:

THE PRELIMINARY RESULTS OF TWO STUDIES INVESTIGATING THE RELATIVE EFFECTIVENESS OF (1) CRT VS. HARDCOPY, AND (2) CRT VS. TELETYPE MODES OF LOGISTIC MANAGEMENT INFORMATION DISPLAY ARE PRESENTED. STUDY 1 INVOLVED A PROTOTYPE INVENTORY MANAGEMENT REPORT AND REQUIRED A BROAD RANGE OF LOGISTIC ORIENTED, INTERACTIVE TASKS. SUBJECTS IN STUDY 2 WERE ASKED TO TO PLAY AN INVENTORY MANAGEMENT GAME IN WHICH THEY HAD TO SUPPORT ONE ITEM AT A DEPOT AND THREE BASES AT MINIMUM COST OVER A SIMULATED SIX MONTH PERIOD. PRIMARY EMPHASIS IN BOTH STUDIES WAS PLACED UPON EVALUATION OF USER ACCEPTANCE OF THE CRT THROUGH SIMILARLY DESIGNED QUESTIONNAIRES. SUBJECTS IN STUDY 1 WERE WILLING TO PAY A MAN WORKING WITH A CRT \$1166 LESS PER YEAR THAN ONE WORKING WITH CONVENTIAL COMPUTER-PRINTED MATERIALS AND JUDGED THE CRT PROCEDURE TO BE 19% LESS BORING THAT THE HARDCOPY EQUIVALENT. STUDY 2 HIGHLIGHTED THE REQUIREMENT FOR ERROR DETECTION RECOVERY ROUTINES IN THE INTERACTIVE CRT ENVIRONMENT. (A)

COMMENTS:

ALTHOUGH AN EXPERIMENT COMPARING USER ATTITUDES TOWARD VARIOUS OUTPUT DEVICES WOULD BE USEFUL, THIS PAPER DOES NOT SATISFY THIS OBJECTIVE. THERE ARE SEVERAL REASONS MMY THE RESULTS REPORTED IN THIS PAPER MAY NOT ACCURATELY REFLECT USER ATTITUDES. FOR ONE, THE SAMPLE SIZES USED ARE PROBABLY TOO SMALL IN RELATION TO THE EXTREME VARIABILITY THAT CAN BE OBSERVED IN QUESTIONNAIRE DATA. IN ADDITION, SUBJECTS PERCEPTION OF THE EXPERIMENTER'S EXPECTATIONS COULD EASILY INFLUENCE THE QUESTIONNAIRE RESULTS. THIS WOULD BE ESPECIALLY SERIOUS IF, FOR EXAMPLE, CRTS WERE RELATIVELY NOVEL TO THE SUBJECTS AND WERE INTRODUCED JUST PRIOR TO THE EXPERIMENT OR IF ADDITIONAL TRAINING WAS GIVEN IN USE OF THE CRTS. IT IS ALSO POSSIBLE THAT THE EXPERIMENTAL CONDITION TO WHICH SUBJECTS WERE ASSIGNED COULD INFLUENCE THEIR JUDGMENTS. NEITHER THIS INFORMATION, NOR SUBJECT PERFORMANCE DATA, ARE PRESENTED IN THIS PAPER. ADDITIONAL EXPERIMENTS ARE REQUIRED TO EVALUATE USER ATTITUDES TOWARD OUTPUT DEVICES.

319 CONFERENCE REPORT ON MAN-COMPUTER INTERACTION
MATHIEU, R.D. MAN-COMPUTER INTERACTION CONFERENCE, NATIONAL PHYSICAL
LABORATORY, TEDDINGTON, MIDDLESEX, ENGLAND (CONFERENCE REPORT) (TECHNICAL
REPORT ONRL-C-11-71). LONDON, ENGLAND: OFFICE OF NAVAL RESEARCH, JUNE 1971.
(NTIS NO. AD 728377)

DESCRIPTION:

WITHIN THE PAST FEW YEARS GREAT STRIDES HAVE BEEN MADE IN COMPUTER

TECHNOLOGY, IN PARTICULAR IN REMOTE-TERMINAL TIME-SHARING FACILITIES AND
COMPUTER LANGUAGES. FOR THE FIRST TIME THE COMPUTER AND ITS TREMENDOUS
POWERS HAVE BEEN BROUGHT WITHIN THE REACH OF SUCH PEOPLE AS TEACHERS,
DOCTORS, MANAGERS, ARCHITECTS, DESIGNERS, ETC. THIS REPORT DESCRIBES THE
PROCEEDINGS OF THE MAN-COMPUTER IMTERACTION CONFERENCE, WHICH WAS HELD AT THE
NATIONAL PHYSICAL LABORATORY, TEDDINGTON, ENGLAND, ON 2-4 SEPTEMBER 1970.
EMPHASIS WAS PLACED ON THE COMPUTER USE AND COMPUTER APPLICATIONS. (A)
THE AUTHOR PRESENTS BRIEF DISCUSSIONS OF SELECTED PAPERS.

12P, 0 COMMENTS:

THIS PAPER PRESENTS A BRIEF SUMMARY OF THE STATE-OF-THE-ART IN MAN-COMPUTER INTERACTION IN THE UNITED KINGDOM. ONE INTERESTING POINT THAT IS MADE IN THIS PAPER IS THE NEED FOR A CLOSER INTERACTION BETWEEN THE HUMAN SCIENCES AND THE COMPUTER SCIENCES IN THE DESIGN OF INTERACTIVE SYSTEMS. ALTHOUGH BRIEF AND NON-TECHNICAL, THIS PAPER MAY BE OF GENERAL INTEREST TO THOSE CONCERNED WITH MAN-COMPUTER INTERACTION.

320 HUMAN FACTORS IN COMPUTER-ASSISTED INSTRUCTION
MAYER, S.R. HUMAN ENGINEERING IN THE DESIGN OF INSTRUCTIONAL SYSTEMS
(REPORT NO. ESD-TR-64-454). L.G. HAMSCOM FIELD, BEDFORD, MASSACHUSETTS:
ELECTRONICS SYSTEMS DIVISION, DECISION SCIENCES LABORATORY, SEPTEMBER 1964.
(NTIS NO. AD 609368)
DESCRIPTION:

A CONCEPTUAL MODEL IS PROPOSED FOR THE USE IN THE APPLICATION OF HUMAN ENGINEERING PRINCIPLES AND TECHNIQUES TO THE DESIGN OF INSTRUCTIONAL SYSTEMS. THE TRAINEE AND INSTRUCTOR ARE VIEWED AS OPERATORS WITHIN AN INFORMATIONAL SYSTEM. TO ILLUSTRATE THIS MODEL AND ITS APPLICATION, EXAMPLES ARE DRAWN FROM CURRENT RESEARCH ON INSTRUCTIONAL SYSTEMS. A PRELIMINARY HUMAN ENGINEERING GUIDE IS DUTLINED WHICH PRESENTS FACTORS CRITICAL TO DESIGN DECISIONS FOR INSTRUCTIONAL SYSTEMS.

THE MODEL AND GUIDE ATTEMPT TO COUNTERACT CURRENT TENDENCIES TOWARD PREMATURE STANDARDIZATION OF INSTRUCTIONAL SYSTEM STRUCTURE, AND TO BRING INSTRUCTIONAL SYSTEM DEVELOPMENT INTO THE MAIN STREAM OF THE APPLIED SCIENCE OF HUMAN ENGINEERING. (A) 19P, 11R.

COMMENTS:

ALTHOUGH THIS IS A FAIRLY EARLY DISCUSSION OF COMPUTER-ASSISTED INSTRUCTION AND COMPUTER-AUGMENTED INSTRUCTION, THIS PAPER CONTAINS SEVERAL INTERESTING CONCEPTS. THE AUTHOR MAKES A STRONG CASE FOR INVOLVING HUMAN FACTORS PERSONNEL IN INSTRUCTIONAL SYSTEM DESIGN AND PRESENTS A FEASIBLE DESCRIPTION OF HOW SUCH SYSTEMS SHOULD BE DEVELOPED. THE SYSTEM AND THE USER ARE DISCUSSED IN TERMS OF INFORMATION PROCESSING AND IT IS INTERESTING TO NOTE THAT MANY OF THE IDEAS EXPRESSED IN THIS PAPER ARE CONSISTENT WITH CURRENT THEORIES OF COGNITIVE PSYCHOLOGY. THIS PAPER COULD BE OF INTEREST TO THOSE CONCERNED WITH INTERACTIVE SYSTEMS IN GENERAL OR WITH INSTRUCTIONAL SYSTEMS.

321 EMBEDDED TRAINING

MAYER, S.R. COMPUTER-BASED SUBSYSTEMS FOR TRAINING THE USERS OF COMPUTER SYSTEMS. IEEE TRANSACTIONS ON HUMAN FACTORS IN ELECTRONICS, 1967, HFE-8, 70-75.

DESCRIPTION:

THIS PAPER EXAMINES THE TRAINING PROBLEMS GENERATED BY COMPUTER-BASED INFORMATION SYSTEMS, AND IT DESCRIBES THE ROLE OF THE COMPUTER IN SOLVING THESE TRAINING PROBLEMS. THE DESIGN AND DEVELOPMENT OF A MODEL FOR A COMPUTER-BASED INSTRUCTIONAL SUB-SYSTEM FOR A MILITARY INFORMATION SYSTEM IS OUTLINED. (A)

6P, 9R. COMMENTS:

THIS PAPER BRIEFLY DESCRIBES THE CONCEPT OF AN "AUTOMATED TRAINING SUBSYSTEM." THE BASIC PRINCIPLE UNDERLYING THE DEVELOPMENT OF SUCH SYSTEMS IS THAT THE USER LEARNS TO USE THE SYSTEM BY ACTUALLY INTERACTING WITH THE SYSTEM RATHER THAN THROUGH FORMAL CLASSROOM TRAINING. THIS SHOULD BE A VERY EFFECTIVE TRAINING TECHNIQUE. IN ADDITION, RECORDS OF STUDENTS INTERACTING WITH THE SYSTEM CAN BE MAINTAINED. AN ANALYSIS OF THESE DATA COULD SUGGEST AREAS WHERE IMPROVEMENTS COULD BE MADE BOTH IN THE TRAINING SUBSYSTEM AND THE SYSTEM ITSELF.

322 TRENDS AND RESEARCH NEEDS

MAYER, S.R. TRENDS IN HUMAN FACTORS RESEARCH FOR MILITARY INFORMATION SYSTEMS. HUMAN FACTORS, 1970, 12, 177-186. DESCRIPTION:

MILITARY INFORMATION SYSTEMS ARE SURVEYED IN AN HISTORICAL CONTEXT STARTING WITH THE SAGE SYSTEM OF THE 1950'S AND PROJECTING TO THE ANTICIPATED SUPERSYSTEMS OF THE 1970'S. HUMAN FUNCTIONS IN DEVELOPMENT, OPERATION, AND USE OF THESE SYSTEMS ARE CONSIDERED FROM A HUMAN FACTORS POINT OF VIEW. THIS EVOLUTIONARY OVERVIEW SHOWS HOW HARDWARE AND SOFTWARE DESIGN IMPACT ON HUMAN PERFORMANCE AND HOW THIS IMPACT HAS FOCUSED AND EXPANDED RESEARCH IN THE COMPUTER SCIENCES AND IN THE BEHAVIORAL SCIENCES. THE EVOLVING HUMAN FUNCTIONS IN MILITARY INFORMATION SYSTEMS ARE DESCRIBED. THESE DESCRIPTIONS SERVE AS A BASIS FOR DEFINING AND RESEARCHING CRITICAL HUMAN FACTORS OPPORTUNITIES AND PROBLEMS. PARALLELING THIS ANALYSIS IS A REVIEW OF SEVERAL PAST, CURRENT, AND FUTURE TRENDS IN HUMAN FACTORS RESEARCH FOR FUTURE MILITARY INFORMATION SYSTEMS. (A) 10P, 27R.

COMMENTS:

THIS IS A BRIEF, WELL-WRITTEN OVERVIEW OF HUMAN FACTORS IN INFORMATION SYSTEMS. THE TREMDS IN BOTH COMPUTER TECHNOLOGY AND HUMAN FACTORS TECHNOLOGY OUTLINED IN THIS PAPER HAVE LARGELY BEEN REALIZED SINCE THIS PAPER WAS WRITTEN. THE AUTHOR CONCLUDES THAT THE MOST PRESSING PROBLEMS ARE IN THE AREA OF COGNITIVE SKILLS. RESEARCH IN THIS AREA, HOWEVER, HAS BEEN SLOW TO MATERIALIZE.

# 323 BIBLIOGRAPHIC SYSTEMS

MCALLISTER, C., & BELL, J.M. HUMAN FACTORS IN THE DESIGN OF AN INTERACTIVE LIBRARY SYSTEM. JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE, 1971, 22, 96-104.

## DESCRIPTION:

ELMS (EXPERIMENTAL LIBRARY MANAGEMENT SYSTEM) IS AN EXPERIMENTAL SYSTEM FOR TOTAL LIBRARY MANAGEMENT, OPERATING ON-LINE. THE SYSTEM IS DESIGNED TO HANDLE LARGE AMOUNTS OF HIGHLY VARIABLE INFORMATION WHICH IT PROCESSES ON COMMAND, GIVING ON-LINE COMPUTER SERVICE FOR ALL LIBRARY OPERATIONS. AT THE SAME TIME, IT MUST ACCOMMODATE THE DIFFERENT NEEDS AND SKILLS OF A BROAD

RANGE OF LIBRARY USERS, FROM NEW PATRONS TO WELL-TRAINED LIBRARIANS.

SUCH A SYSTEM PRESENTS PROGRAMMING PROBLEMS THAT WILL BE TYPICAL OF
LARGE, INTERACTIVE COMPUTER SYSTEMS IN THE SEVENTIES. THIS PAPER DISCUSSES
ELMS FEATURES THAT FACILITATE USER INTERACTION, AND MAY PROVE USEFUL IN
SIMILAR SYSTEMS; TECHNIQUES FOR TUTORING THE USER (DISPLAY FORMAT, ONEQUESTION, ONE-ANSWER DISPLAYS, AND KWIC INDEXING); ADAPTABILITY FOR THE
EXPERIENCED USER (COMMAND CHAINS AND A STANDARD SET OF FOUR-LETTER MNEMONIC
CODES FOR HIGHER-LEVEL CONTROL); MINIMIZATION OF KEYING (LINE NUMBERS,
ONE-CHARACTER MNEMONIC CODES USED WITH PROCEDURES, AND USE OF DEFAULT
CONDITIONS); PERFORMANCE OF CLERICAL TASKS BY EXCEPTION NOTIFICATION; AND
COLLECTION OF OPERATIONAL STATISTICS TO HELP IMPROVE THE SYSTEM. (A)
9P, 10R.

### COMMENTS:

THE SYSTEM DESCRIBED IN THIS PAPER IS VERY AMBITIOUS IN THAT IT IS INTENDED TO BE APPLICABLE TO A VARIETY OF TYPES OF LIBRARIES (E.G., ACADEMIC, PUBLIC) AND USEABLE BY A WIDE VARIETY OF USERS. A CENTRAL COMPONENT OF THIS SYSTEM IS "ONE-QUESTION, ONE-ANSWER" DISPLAYS. ALTHOUGH THIS FEATURE CAN FACILITATE USE BY NOVICE USERS, IT CAN BE BURDENSOME FOR MORE EXPERIENCED USERS. ALTHOUGH THE MORE EXPERIENCED USER CAN INPUT A CHAIN OF COMMANDS AND SKIP OVER SOME OF THESE DISPLAYS, A LARGE NUMBER OF DISPLAYS OR ENTRIES EACH CONVEYING VERY LITTLE INFORMATION DOES NOT APPEAR TO BE COMPATIBLE WITH THE EXPERIENCED USER'S VIEW OF HIS TASK. FOR EXAMPLE, THE AUTHORS STATE THAT ORDERING A NEW BOOK REQUIRES 84 SEPARATE FRAMES, SOME OF WHICH MAY BE SKIPPED BY COMMAND CHAINING; IT MAY BE THE CASE, HOWEVER, THAT THE EXPERIENCED USER VIEWS ORDERING AS A SINGLE TASK AND WOULD PREFER A SINGLE, WELL ORGANIZED DISPLAY. ALTHOUGH PROBLEMS ASSOCIATED WITH LARGE DATA BASES ARE CONSIDERED (E.G., MAINTAINING FILE CONSISTENCY) AND IMPLEMENTATION PROBLEMS ARE BRIEFLY DISCUSSED, HUMAN FACTORS ASPECTS OF DISPLAYS AND MANCOMPUTER DIALOGUES ARE NOT ADEQUATELY CONSIDERED. THERE IS NO ATTEMPT TO REVIEW OR INTEGRATE RELEVANT HUMAN FACTORS LITERATURE INTO THE DESIGN OF THE SYSTEM DISCUSSED IN THIS PAPER.

## 324 NATURAL-LANGUAGE DIALOGUE

MCGUIRE, M.T., LORCH, S., & QUARTON, G.C. MAN-MACHINE NATURAL LANGUAGE EXCHANGES BASED ON SELECTED FEATURES OF UNRESTRICTED INPUT: II. THE USE OF THE TIME-SHARED COMPUTER AS A RESEARCH TOOL IN STUDYING DYADIC COMMUNICATION. JOURNAL OF PSYCHIATRIC RESEARCH, 1967, 5, 179-191. DESCRIPTION:

THIS PAPER REPORTS A STUDY USING A TIME-SHARED COMPUTER AND A NATURAL LANGUAGE COMMUNICATION PROGRAM (ELIZA) TO STUDY DYADIC COMMUNICATION. THE OVERALL OBJECTIVES WERE: (1) TO OBSERVE PHENOMENOLOGICAL FEATURES OF NATURAL LANGUAGE EXCHANGES BETWEEN MAN AND MACHINE; (2) TO STUDY THE PHENOMENON OF MACHINE UNDERSTANDING CREATED BY LANGUAGE EXCHANGES BASED ON SELECTED FEATURES OF UNRESTRICTED INPUT IN MAN-MACHINE WRITTEN LANGUAGE BEHAVIOR; AND (3) TO ACQUIRE EXPERIENCE IN SCRIPT WRITING AND REVISION OF SCRIPT WEAKNESS DISCOVERED IN ACTUAL TESTING OF SUBJECTS. (A, ABBR.)

## COMMENTS:

THIS PAPER IS CONCERNED WITH A COMPUTER SYSTEM THAT GIVES THE APPEARANCE OF NATURAL LANGUAGE DIALOGUE WITHOUT ACTUALLY UNDERSTANDING THE CONTENT AND TOPICS OF DISCUSSION. SUCH SYSTEMS CAN BE IMPLEMENTED RELATIVELY QUICKLY AND INEXPENSIVELY. THIS PAPER TESTS WHETHER A NAIVE USER COULD PERCEIVE THE SYSTEM'S OUTPUTS AS COMING FROM A HUMAN OR A MACHINE. A MORE IMPORTANT ISSUE FOR MAN-MACHINE DIALOGUE IS WHETHER THE USER CAN FUNCTION EFFECTIVELY WITH AND ACCEPT THIS TYPE OF DIALOGUE. THE RESULTS OF THIS PAPER SUGGEST THAT THIS MAY BE THE CASE. THE TYPE OF TASKS IN WHICH SUCH A DIALOGUE WOULD BE EFFECTIVE REMAINS TO BE CONSIDERED.

DESCRIPTION:

PROBLEM AREAS IDENTIFIED THROUGH FIELD EXERCISE OBSERVATIONS ARE REVIEWED IN THE CONTEXT OF GREATEST APPLICABILITY OF LABORATORY RESEARCH DONE BY BESRL AS WELL AS THE FEASIBILITY OF PROCEDURAL MODIFICATIONS INDICATED BY THE RESEARCH FINDINGS. MAJOR PRINCIPLES PERTAINING TO SPECIFIC OPERATIONAL NEEDS ARE DEFINED. THESE ARE THEN TRANSLATED INTO SUGGESTIONS AND THEIR APPLICATION ILLUSTRATED BY SPECIFIC EXAMPLES (ESPECIALLY WITH REFERENCE TO THE POTENTIAL OF TOTE-TYPE DISPLAYS AND SIMPLE CODING TECHNIQUES FACILITATING INFORMATION PRESENTATION AND ASSIMILATION). RESEARCH NEEDS BEARING ON HUMAN FACTOR PROBLEMS INVOLVED IN DECISION-MAKING TASKS IN THE OPERATIONAL SETTING ARE ALSO DISCUSSED. (A.ABBR.)
36P, 10R.

COMMENTS:

THIS PAPER PRESENTS A BRIEF REVIEW OF RESEARCH CONCERNED WITH DISPLAY FACTORS THAT AFFECT THE USER'S ABILITY TO ASSIMILATE INFORMATION. ALTHOUGH THESE EXPERIMENTS ARE NOT DESCRIBED IN ANY DETAIL, THE MAJOR RESULTS ARE CLEARLY PRESENTED. A PRINCIPAL PURPOSE OF THIS PAPER IS TO ARGUE THAT LABORATORY RESEARCH FINDINGS CAN BE APPLIED TO REAL-WORLD OPERATIONAL PROBLEMS. THIS IS AN IMPORTANT QUESTION, AND THIS PAPER CLEARLY INDICATES THAT SUCH FINDINGS ARE APPLICABLE IN TACTICAL OPERATIONS SYSTEMS. THIS PAPER WOULD BE OF INTEREST TO THOSE CONCERNED WITH DISPLAY FACTORS AND ESPECIALLY WITH CODING TECHNIQUES.

326 USER REQUIREMENTS DEFINITION

MCKENDRY, J.M., WILSON, R.C., MACE, D.J., & BAKER, J.D. APPLICATION OF

A METHOD FOR DETERMINING INFORMATION REQUIREMENTS IN A FIELD ARMY (TECHNICAL
PAPER 247). ARLINGTON, VIRGINIA: U.S. ARMY RESEARCH INSTITUTE FOR THE
BEHAVIORAL AND SOCIAL SCIENCES, AUGUST 1973. (NTIS NO. AD 767262)

DESCRIPTION:

A SURVEY INSTRUMENT WAS DEVISED FOR ANALYZING USER INFORMATION REQUIREMENTS IN A TACTICAL OPERATIONS SYSTEM. THE SURVEY LISTED COMMONLY USED INFORMATION ITEMS, WITH SUBDIVISIONS INDICATING THE LEVEL OF DETAIL DESIRED. A VARIETY OF PERSONNEL COMPLETED THE SURVEY AND THEIR SUBJECTIVE JUDGEMENTS WERE CONVERTED SO THAT EACH PERSON'S RESPONSE RECEIVED EQUAL WEIGHT EVEN THOUGH THE NUMBER OF INFORMATION ITEMS CONSIDERED IMPORTANT VARIED FROM PERSON TO PERSON.

THE METHODOLOGY AND TECHNIQUES EMPLOYED HERE FOR DETERMINING USER INFORMATION REQUIREMENTS ARE CAPABLE OF PRODUCING CRITERIA FOR MEASURING HOW THOROUGHLY INFORMATION IS DISSEMINATED IN A GIVEN SYSTEM. BEYOND THIS IMMEDIATE USE, SUCH METHODOLOGY AND TECHNIQUES COULD PROVE USEFUL FOR GENERATING STAFF/USER INFORMATION REQUIREMENTS FOR A VARIETY OF ARMY TACTICAL DATA SYSTEMS, WHICH IN TURN COULD INFLUENCE DATA BASE STRUCTURE AND DISPLAY DESIGN. (A) 25P, 4R.

IN ORDER TO DETERMINE HOW THOROUGHLY INFORMATION IS DISSEMINATED IN A GIVEN SYSTEM, IT IS NECESSARY TO HAVE SOME CRITERION WITH WHICH TO COMPARE THE AVAILABLE INFORMATION. THIS PAPER CONSIDERS SUCH A CRITERION FOR TACTICAL OPERATIONS SYSTEMS. THIS PAPER CLEARLY ILLUSTRATES THAT INFORMATION REQUIREMENTS ARE TASK-SPECIFIC. ALTHOUGH THE TECHNIQUE DESCRIBED HERE MAY BE EFFECTIVE IN SOME SITUATIONS, IT IS IMPORTANT TO NOTICE A MAJOR LIMITATION. AS IMPLEMENTED HERE, THE TECHNIQUE CONSIDERS ONLY CURRENTLY AVAILABLE INFORMATION. RELEVANT INFORMATION NOT NOW AVAILABLE IN A GIVEN SYSTEM IS NOT CONSIDERED.

327 USER ACCEPTANCE
MCLEAN, E.R. THE HUMAN SIDE OF SYSTEMS: THE USER'S PERSPECTIVE (INFORMATION
SYSTEMS WORKING PAPER 2-77). LOS ANGELES, CALIFORNIA: UNIVERSITY OF
CALIFORNIA, GRADUATE SCHOOL OF MANAGEMENT, CENTER FOR INFORMATION STUDIES,
JULY 1976 (PAPER PRESENTED AT THE 1976 WESTERN SYSTEMS CONFERENCE, LOS ANGELES,
CA, OCTOBER 1976).
DESCRIPTION:

IN APPROACHING THE DESIGN AND INSTALLATION OF COMPUTER-BASED SYSTEMS, A NUMBER OF HUMAN FACTORS ARE PRESENT WHICH CAN INTERFERE WITH SUCCESSFUL IMPLEMENTATION. ON THE PART OF THE USER, THESE INCLUDE ECONOMIC, ORGANIZATIONAL, AND PSYCHOLOGICAL FACTORS WHICH MUST BE RECOGNIZED AND UNDERSTOOD IF THE SYSTEMS DEVELOPMENT EFFORT IS TO AVOID THE PITFALLS WHICH ARE SO OFTEN ENCOUNTERED IN PROJECTS OF THIS SORT.

TO THE EXTENT THAT THE DESIGNER IS AWARE OF THESE FACTORS -- AND THEIR UNDERLYING CAUSES -- HE OR SHE IS MUCH BETTER PREPARED TO DEAL WITH THEM. THIS PAPER EXPLORES THESE FACTORS AND THEIR IMPLICATIONS FOR EFFECTIVE DESIGN PRACTICE. (A) BP, OR.

COMMENTS:

WHILE MOST PAPERS THAT CONSIDER THE TOPIC OF USER ACCEPTANCE FOCUS PRIMARILY ON THE INTERFACE BETWEEN THE USER AND THE SYSTEM (E.G., K.D. EASON, 1976), THE PRESENT PAPER IS PRIMARILY CONCERNED WITH FACTORS AFFECTING USER ACCEPTANCE DURING THE SYSTEM INSTALLATION PHASE. ALTHOUGH THESE FACTORS MAY BE, IN SOME CASES, IMPORTANT, IT MAY ALSO BE POSSIBLE TO ELIMINATE, OR AT LEAST REDUCE, THESE EFFECTS BEFORE SYSTEM INSTALLATION BEGINS. IF THE ULTIMATE USERS WERE CLOSELY INVOLVED IN THE SYSTEM DESIGN AND THE EVALUATION OF PROTOTYPE SYSTEMS, SOME OF HE PROBLEM AREAS DESCRIBED IN THIS PAPER MAY BE ELIMINATED BEFORE THE ACTUAL INSTALLATION. AS THE AUTHOR NOTES, HOWEVER, SOME OF THESE FACTORS MAY MAKE THE ULTIMATE USER RELUCTANT TO EVEN PARTICIPATE IN THE SYSTEM DESIGN PHASE. ALTHOUGH GUIDELINES FOR DEALING WITH THESE FACTORS ARE NOT PRESENTED, THIS PAPER DOES CONTAIN IDEAS THAT WOULD BE OF INTEREST TO SYSTEM DESIGNERS.

328 MAN-COMPUTER DIALOGUE
MEADOW, C.T. MAN-MACHINE COMMUNICATION. NEW YORK: WILEY, 1970.
DESCRIPTION:

THIS BOOK BROADLY SURVEYS CURRENT PRACTICES IN MAN-COMPUTER COMMUNICATION. IT DISCUSSES A VARIETY OF INPUT/OUTPUT DEVICES, AND INTRODUCES CONCEPTS INVOLVED IN PROGRAMMING, TIME-SHARING, AND NATURAL-LANGUAGE COMMUNICATION. IT PROVIDES AN INTRODUCTION, DISCUSSION OF BASIC ISSUES, AND DIALOGUE EXAMPLES IN EACH OF SEVERAL COMPUTER APPLICATION AREAS. THESE AREAS INCLUDE INFORMATION RETRIEVAL, INFORMATION ACQUISITION, OR DATA ENTRY, COMPUTER-ASSISTED INSTRUCTION, TEXT EDITING, INTERACTIVE PROGRAMMING, COMPUTER-AIDED DESIGN, AND MANAGEMENT INFORMATION SYSTEMS.

COMMENTS:

THIS BOOK IS PRIMARILY A DESCRIPTIVE SURVEY OF CURRENT PRACTICES IN INTERACTIVE SYSTEMS. IT PROVIDES A GOOD INTRODUCTION TO A VARIETY OF INTERACTIVE APPLICATIONS, BUT DOES NOT TREAT HUMAN FACTORS ISSUES IN ANY REAL DETAIL. IT ALSO DISCUSSES SOME OF THE IMPLEMENTATION PROBLEMS ASSOCIATED WITH VARIOUS DIALOGUE TYPES. THIS IS A GOOD SOURCE FOR THOSE WITH A HUMAN FACTORS OR BATCH PROGRAMMING BACKGROUND, BUT NO EXPERIENCE WITH INTERACTIVE COMPUTER SYSTEMS, WHO WANT A QUICK INTRODUCTION TO THE LATTER.

329 MAN-COMPUTER TASK ALLOCATION
MELCHING, W.H. A CONCEPT OF THE ROLE OF MAN IN AUTOMATED SYSTEMS (PROFESSIONAL PAPER 14-68). ALEXANDRIA, VIRGINIA: GEORGE WASHINGTON UNIVERSITY, HUMAN RESOURCES RESEARCH OFFICE, MAY 1968. (NIIS NO. AD 671128)

DESCRIPTION:

A PROBLEM THAT HAS LONG PLAGUED SYSTEM DESIGNERS AND HUMAN FACTORS ENGINEERS IS THAT OF ALLOCATION OF FUNCTIONS BETWEEN MAN AND MACHINE. THIS PAPER REPORTS AN ATTEMPT TO ISOLATE AND IDENTIFY FACTORS PERTINENT TO MAKING ALLOCATION DECISIONS. FROM AN AMALYSIS OF THE FUNCTIONS AND MISSIONS OF SEVERAL AUTOMATED SYSTEMS, SIX FACTORS WERE SHOWN TO HE HIGHLY RELEVANT TO ALLOCATION DECISIONS. ONE FACTOR, MAN'S ROLE IN AUTOMATED SYSTEMS, EMERGED AS A VARIABLE OF PARTICULAR INTEREST. IN ADDITION, FOUR CLASSES OF MANUAL FUNCTIONS COMMON TO ALL AUTOMATED SYSTEMS WERE IDENTIFIED. IT WAS DETERMINED THAT THESE CLASSES, IN TURN, CONSTITUTED A MEANINGFUL DESCRIPTION OF THE ROLE OF MAN IN TODAY'S AUTOMATED SYSTEMS. (A)

8P, 8R. COMMENTS: 4 4

THIS PAPER PRESENTS A GENERAL, EASY TO READ DISCUSSION OF MAN-MACHINE TASK ALLOCATION. THE FACTORS THAT THE AUTHOR IDENTIFIES AS BEING RELEVANT TO ALLOCATION DECISIONS APPEAR TO BE OBVIOUS (E.G., THE CURRENT STATE-OF-THE-ART) AND DO NOT APPEAR TO PROVIDE USEFUL INSIGHTS. THE FOUR CLASSES OF MANUAL FUNCTIONS PROPOSED IN THIS PAPER (FACILITATE, OVERRIDE, CONTROL, AND PERMIT SYSTEM OPERATION) DO NOT CONSTITUTE AN ADEQUATE TAXONOMY OF THE TYPES OF FUNCTIONS THAT CAN BE ALLOCATED TO THE HUMAN OPERATOR, BUT THEY MAY BE USEFUL IN CONSTRUCTING MORE DETAILED TAXONOMIES.

330 PETRI NETS FOR MODELING INTERACTIVE SYSTEMS
MELDMAN, J.A. A NEW TECHNIQUE FOR MODELING THE BEHAVIOR OF MAN-MACHINE
INFORMATION SYSTEMS. SLOAN MANAGEMENT REVIEW, 1977, 18(3), 29-46.
DESCRIPTION:

A SERIOUS PROBLEM IN UNDERSTANDING OR DESIGNING MAN-MACHINE SYSTEMS IS THE LACK OF POWERFUL, FORMAL TECHNIQUES FOR MODELING, OR DESCRIBING MAN-MACHINE INTERACTIONS. THIS PAPER FOCUSES ON MAN-MACHINE INTERACTIONS IN MANAGEMENT INFORMATION SYSTEM HAS FOUR CRUCIAL CHARACTERISTICS THAT COMPLICATE MODELING -- A LARGE NUMBER OF INTERACTING SUBSYSTEMS, HIGHLY PARALLEL BEHAVIOR, ASYNCHRONOUS COORDINATION OF SUBSYSTEMS, AND ALTERNATIVE BEHAVIOR OF SUBSYSTEMS. IT IS SUGGESTED THAT PETRI NETS OFFER A TECHNIQUE FOR MODELING THAT IS FORMAL AND EXPLICIT, HIGHLY MODULAR, AND COMPREHENSIVE AND CAN AID IN BETTER UNDERSTANDING MAN-MACHINE INTERACTIONS.

18P, 21R. COMMENTS:

THE FOCUS OF THIS PAPER IS ON MODELING MAN-MACHINE INTERACTIONS IN MANAGEMENT INFORMATION SYSTEMS RATHER THAN ON HUMAN FACTORS ASPECTS OF MANAGEMENT INFORMATION SYSTEMS. PETRI NETS, AS DESCRIBED HERE, APPEAR TO OFFER A CONVENIENT METHOD FOR REPRESENTING THE BEHAVIOR OF A PROPOSED SYSTEM AND MAY BE USEFUL, THEREFORE, IN USER REQUIREMENTS ANALYSIS AND IN EXAMINING THE PROBABLE EFFECTS OF SYSTEM MODIFICATIONS.

331 USER ACCEPTANCE

MELNYK, V. MAN-MACHINE INTERFACE: FRUSTRATION. JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE, 1972, 23, 392-401. DESCRIPTION:

AS AN EXPLORATION OF THE FRUSTRATION OF USERS OF AN ON-LINE INTERACTIVE RETRIEVAL SYSTEM, STUDENTS FROM THE SCHOOL OF LIBRARY SCIENCE OF SYRACUSE UNIVERSITY PARTICIPATED IN AN EXPERIMENT USING AN EXPERIMENTAL REFERENCE RETRIEVAL SYSTEM FOR LIBRARY LITERATURE ON THE IBM SYSTEM 360/50. THE SEARCHING CONSISTED OF SAMPLE SEARCHES USING KEY-WORDS. THE DATA BASE CONTAINED LIBRARY LITERATURE CITATIONS FOR THE YEAR 1970.

IN THE CONTROL GROUP, STUDENTS WERE INSTRUCTED TO LOCATE LITERATURE RELATED TO LIBRARY MANAGEMENT AND INFORMATION RETRIEVAL SYSTEMS. THE PARTICULAR TERMS IN THE SEARCH AND THE FORMAT WERE OUTLINED IN AN INSTRUCTION SESSION BEFORE THE STUDENTS USED THE SYSTEM.

THE EXPERIMENTAL GROUP WAS NOT RESTRICTED TO A SAMPLE SEARCH, OR SPECIFIED SEARCH TERMS, BUT THE FORMAT OF THE SEARCHES WERE TO BE THE SAME AS THE CONTROL GROUP.

IT WAS ANTICIPATED THAT SIGNIFICANT VARIATIONS IN THE BEHAVIOR OF THE USERS WOULD BE DISPLAYED AND IDENTIFIED BY COMPARING MEASURES OF BEHAVIOR AS THE MAN-COMPUTER INTERACTION PROCEEDED THROUGH THE SEARCH PROCESS. (A) 10P. 19R.

COMMENTS:

INTUITIVELY, FRUSTRATION SHOULD HAVE SIGNIFICANT EFFECTS ON USER ACCEPTANCE AND USER PERFORMANCE. THE PURPOSE OF THIS EXPERIMENT WAS TO DETERMINE HOW FRUSTRATION WOULD AFFECT USER BEHAVIOR. THIS EXPERIMENT, HOWEVER IS POORLY DESCRIBED AND THERE APPEAR TO BE SEVERAL ASPECTS THAT PREVENT THE RESULTS FROM BEING USEFULLY INTERPRETED. FIRST, SUBJECTS IN THE "FRUSTRATION CONDITION" WERE APPARENTLY GIVEN LITTLE, OR NO, INSTRUCTION AS TO THE TASK THEY WERE TO PERFORM WHILE SUBJECTS IN THE OTHER CONDITION WERE APPARENTLY TOLD HOW TO PERFORM THE TASK. SECOND, THE EXPERIMENTAL MEASURES WERE A SUBJECTIVE ESTIMATE OF EACH SUBJECT'S LEVEL OF FRUSTRATION AND A SUBJECT-COMPLETED OPINION QUESTIONNAIRE; SOME MEASURE OF PERFORMANCE WOULD APPEAR TO BE APPROPRIATE. THIRD, IT IS NOT CLEAR HOW DATA WERE SCORED OR WHETHER THE REPORTED ANALYSES ARE APPROPRIATE. ALTHOUGH THE INTENT OF THIS RESEARCH IS NOTEWORTHY, THIS EXPERIMENT IS OF VERY LITTLE PRACTICAL USE. SOME READERS, HOWEVER, MAY BE INTERESTED IN THE BRIEF REVIEW OF RESEARCH ON FRUSTRATION PROVIDED IN THE INTRODUCTION.

332 ROLE OF HUMAN FACTORS IN NAVY STSTEMS ACQUISITION
MERRIMAN, S.C. HUMAN FACTORS PROGRAMS IN NAVY SYSTEMS ACQUISITION. FT.
BÉLVOIR, VIRGINIA: DEFENSE SYSTEMS MANAGEMENT COLLEGE, NOVEMBER 1976.
(NIIS NO. AD A037775)
DESCRIPTION:

THIS REPORT EXAMINED THE ROLE THAT HUMAN FACTORS PROGRAMS PLAY IN NAVY SYSTEMS ACQUISITION. IT FOCUSED UPON THE CONCEPTUAL AND VALIDATION (ADVANCED DEVELOPMENT) PHASES OF THE ACQUISITION PROCESS SINCE IT IS DURING THIS PERIOD WHEN THE GREAT MAJORITY OF SYSTEM DESIGN DECISIONS ARE MADE. BASED UPON PREVIOUS ANALYSES, INTERVIEW DATA AND THE AUTHOR'S EXPERIENCE, HUMAN FACTORS PROGRAM ACTIVITIES APPROPRIATE TO THE CONCEPTUAL AND VALIDATION PHASES WERE IDENTIFIED AND DISCUSSED RELATIVE TO KEY ACQUISITION PROCESS MILESTONES; E.G., DEVELOPMENT PROPOSAL (DP) AND DECISION COORDINATION PAPER (DCP) PREPARATION, DEFENSE SYSTEM ACQUISITION REVIEW COUNCIL (DSARC) PREPARATION. DEPARTMENT OF THE NAVY SYSTEMS ACQUISITION POLICY WAS BRIEFLY REVIEWED IN TERMS OF ITS EFFECTS ON THE COURSE OF HUMAN FACTORS PROGRAMS. PAST AND PRESENT HUMAN FACTORS PROGRAMS WERE REVIEWED AND DISCUSSED. (A) 57P, 33R.

COMMENTS:

THIS PAPER FOCUSES ONLY ON THE EARLY STAGES OF SYSTEM DESIGN; THIS IS APPROPRIATE SINCE IT IS DURING THESE STAGES THAT HUMAN FACTORS DECISIONS WILL PRODUCE THE LARGEST EFFECTS ON TOTAL SYSTEM PERFORMANCE. THE AUTHOR TREATS HUMAN FACTORS IN TERMS OF WHAT SHOULD BE DONE RATHER THAN HOW IT SHOULD BE DONE. A FAIRLY STRONG CASE IS MADE FOR A COORDINATED AND EXTENSIVE APPROACH TO INVOLVING HUMAN FACTORS SPECIALISTS IN SYSTEM DESIGN AND ACQUISITION.

MAN-COMPUTER PROBLEM SOLVING 333

MAN-COMPUTER PROBLEM SULVING
METCALF, M., & METCALF, G. AN EXAMPLE OF MACHINE-AIDED COGNITION USING
HEURISTIC AND ADAPTIVE PROGRAMMING ON A SMALL-SCALE COMPUTER. IN PROCEEDINGS
OF THE INTERNATIONAL SYMPOSIUM ON MAN-MACHINE SYSTEMS, 8-12 SEPTEMBER 1969 (VOL. 3) (IEEE CONFERENCE RECORD NO. 69C5B-MMS). NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, 1969. DESCRIPTION:

THIS PAPER DESCRIBES A CONTRACT EVALUATION PROGRAM WHICH USES HEURISTIC AND ADAPTIVE PROGRAMMING TECHNIQUES TO AUGMENT THE CAPABILITIES OF A SMALL—SCALE DIGITAL COMPUTER. BY INTEGRATING A MANAGER'S OPINION WITH PAST HISTORY AND APPLYING A RATING SCHEME, THE PROGRAM ESTIMATES THE OUTCOME IN A CONTRACT-BIDDING SITUATION. A RATING IS FORMED BY SUMMING THREE DIFFERENT TERMS: A TERM SUMMARIZING THE MANAGER'S OPINION, A BATTING AVERAGE FOR THE INDIVIDUAL BIDDER, AND A BATTING AVERAGE FOR THE BIDDER'S GENERIC CLASSIFICATION. THE TERM FOR MANAGER'S OPINION IS CONSTRUCTED FROM A SET OF WEIGHTING FACTORS, SELECTED BY AGENCY, AND A SET OF RESPONSES TO SPECIFIC QUESTIONS. RESPONSES ARE WEIGHTED ON A ZERO-TO-FOUR SCALE. THE PROGRAM DISPLAYS A SUMMARY OF THE PARAMETERS USED IN DERIVING THE RATINGS. BY INTERPRETING THESE, A MANAGER IS AIDED IN ESTIMATING HIS COMPANY'S CHANCES IN THE BIDDING SITUATION, ALONG WITH THOSE OF OTHER BIDDERS. (A) 10P, DR.

COMMENTS:

THIS MAN-COMPUTER PROBLEM SOLVING DESCRIBED HERE IS AT A VERY LOW LEVEL OF SOPHISTICATION. BASICALLY, THE USER INPUTS DATA AND THE SYSTEM USES VARIOUS HEURISTICS TO EVALUATE THE SITUATION DESCRIBED BY THE USER. THE SUCCESS OF SUCH A SYSTEM IS A DIRECT FUNCTION OF THE HEURISTICS USED. SINCE A HUMAN PROBLEM SOLVER IS GENERALLY VERY GOOD AT USING PROBLEM SOLVING HEURISTICS, THE VALUE OF THIS SYSTEM IS NOT CLEAR. UNLESS THE USER IS AWARE OF AND CONCURS WITH THE HEURISTICS USED, USER ACCEPTANCE COULD BE EXTREMELY LOW.

#### 334 DISPLAYS

MEZRICH, J.J., CARLSON, C.R., & COMEN, R.W. IMAGE DESCRIPTORS FOR DISPLAYS (TECHNICAL REPORT NO. PRRL-77-CR-7). PRINCETON, NEW JERSEY: RCA LABORATORIES, FEBRUARY 1977. (NTIS NO. AD A042492) DESCRIPTION:

THIS REPORT SUMMARIZES OUR EXPERIMENTAL AND THEORETICAL RESULTS ON THE PERCEPTION OF DISPLAYED INFORMATION. THIS RESEARCH IS CONCERNED WITH FOUR ISSUES: (1) THE EFFECT OF COLOR ON PATTERN RECOGNITION, (2) THE MEASUREMENT OF STATISTICAL ESTIMATES FOR LUMINANCE AND CHROMINANCE INFORMATION IN PICTORIAL SCENES, (3) THE RELATIONSHIP BETWEEN PERCEIVED CHANGES IN IMAGE SHARPNESS RESULTING FROM CHANGES IN DISPLAY MODULATION TRANSFER, AND (4) THE DEVELOPMENT OF A UNIFIED DISPLAY DESCRIPTOR TO MODEL THE PERCEPTION OF BOTH LUMINANCE AND CHROMINANCE INFORMATION.

OUR EXPERIMENTS TO DETERMINE THE UTILITY OF COLOR PROVIDE RESULTS WHICH ESTABLISH AN EMPIRICAL BASIS FOR DETERMINING GENERAL PRINCIPLES ABOUT THE ROLE OF COLOR IN PATTERN RECOGNITION. WE HAVE FOUND THAT COLOR MAY BE IRRELEVANT UNDER CONDITIONS THAT REPRESENT GLOBAL STIMULUS PROCESSING AND WHEN THE SHAPE AND COLOR DIMENSIONS ARE HANDLED AS SEPARABLE. HOWEVER, OUR RESULTS ALSO INDICATE THAT COLOR IS INVOLVED IN THE SHAPE RECOGNITION PROCESS WHEN THE SEPARABLE DIMENSIONS OF COLOR AND SHAPE ARE INTEGRAL OR WHEN THE STIMULUS IS LOCALLY PROCESSED. THUS, OUR EXPERIMENTS HAVE SHOWN THAT SINGLE ANSWER CONCERNING THE UTILITY OF COLOR IN PATTERN RECOGNITION IS NOT TO BE EXPECTED.

NOT TO BE EXPECTED.

IN THIS REPORT A DESCRIPTOR FOR THE TOTAL CHANNEL CAPACITY OF THE DISPLAY-OBSERVER SYSTEM IS DEVELOPED THAT INCLUDES THE STATISTICAL PROPERTIES OF BOTH LUMINANCE AND CHROMINANCE INFORMATION. THIS DESCRIPTOR IS BASED ON A WIDELY ACCEPTED MODEL OF THE VISUAL SYSTEM THAT CONTAINS THREE INDEPENDENT CHANNELS: ONE CHANNEL THAT TRANSMITS THE LUMINANCE INFORMATION, AND TWO CHANNELS THAT TRANSMIT THE CHROMINANCE INFORMATION. FOR THE FIRST TIME THE NONLINEARITIES ASSOCIATED WITH LUMINANCE PERCEPTION ARE INCLUDED IN OUR MODEL THROUGH A NOVEL INTERPRETATION OF RECENT PSYCHOPHYSICAL EXPERIMENTS. THE MODEL FOR THE TOTAL INFORMATION CAPACITY IS USED TO PREDICT THE OPTIMUM ALLOCATION FOR A COMMERCIAL TELEVISION SYSTEMS; THE RESULTS ARE SHOWN TO BE IN GOOD AGREEMENT WITH CURRENT U.S. TELEVISION PACTICES. (A, ABBR.)

#### COMMENTS:

THIS IS A THOROUGH DISCUSSION OF A WELL-MOTIVATED AND CAREFULLY CONDUCTED SERIES OF EXPERIMENTS. THIS RESEARCH IS A GOOD EXAMPLE OF THE TYPE OF WORK NEEDED TO PRODUCE A USEFUL, PRACTICAL GUIDE TO DISPLAY DESIGN. ALTHOUGH PRIMARILY CONCERNED WITH TELEVISION TYPE DISPLAYS, THE RESULTS SHOULD GENERALIZE TO OTHER DISPLAY TYPES.

335 MAN-COMPUTER PROBLEM SOLVING

MICHIE, D., FLEMING, J.G., & OLDFIELD, J.V. A COMPARISON OF HEURISTIC, INTER-ACTIVE, AND UNAIDED METHODS OF SOLVING A SHORTEST-ROUTE PROBLEM. IN D. MICHIE (ED.), MACHINE INTELLIGENCE (VOL 3). NEW YORK: AMERICAN ELSEVIER, 1968, 245-255.

DESCRIPTION:

AN EXPERIMENT WAS CONDUCTED TO COMPARE THREE METHODS OF SOLVING THE "TRAVELLING SALESMAN" PROBLEM: (1) A HUMAN EQUIPPED WITH ONLY PENCIL AND PAPER, (2) A COMPUTER EQUIPPED WITH A HEURISTIC PROBLEM SOLVING PROGRAM, AND (3) A HUMAN EQUIPPED WITH AN INTERACTIVE DISPLAY AND A PROGRAM TO PERMIT EDITING AND EVALUATION OF TRIAL SOLUTIONS. ALTHOUGH IT IS FREQUENTLY ASSUMED THAT THE COOPERATIVE COMBINATION OF MAN AND MACHINE SHOULD BE MORE EFFICIENT THAN EITHER MAN OR MACHINE ALONG, FEW DETAILED QUANTITATIVE TESTS OF THIS HYPOTHESIS HAVE BEEN MADE. IN ADDITION, IT IS SUGGESTED THAT INTERACTIVE TECHNIQUES BE VIEWED NOT AS AN END IN THEMSELVES, BUT RATHER AS A TRANSITIONAL STAGE BETWEEN HAVING THE PROBLEM SOLVED ENTIRELY BY THE HUMAN AND HAVING IT SOLVED ENTIRELY BY THE MACHINE.

COMMENTS:

ALTHOUGH THE AUTHORS' PRIMARY INTEREST IS IN DEVELOPING ARTIFICIAL INTELLIGENCE PROGRAMS TO SOLVE A CLASS OF PROBLEMS, THEY DO PRESENT AN INTERESTING COMPARISON AMONG THREE PROBLEM SOLVING METHODS (MAN-ALONE, MACHINE-ALONE, AND MAN-MACHINE INTERACTION). THE RESULTS OF THIS EXPERIMENT, HOWEVER, ARE NOT STATISTICALLY EVALUATED. THE ARGUMENT IN FAVOR OF DEVELOPING ARTIFICIAL INTELLIGENCE APPROACHES TO PROBLEM SOLVING DOES NOT APPEAR TO BE STRONGLY SUPPORTED. SOME OF THE FEATURES INCORPORATED IN THE INTERACTIVE METHOD, SUCH AS AUTOMATIC EVALUATION OF SOLUTION ATTEMPTS AND THE ABILITY TO RECALL PREVIOUS ATTEMPTS, COULD BE USEFUL ADDITIONS TO INTERACTIVE PROBLEM SOLVING SYSTEMS.

336 USER ACCEPTANCE OF NAVAL COMBAT INFORMATION SYSTEMS
MIELO, H.E. DIGITAL COMPUTERS IN U.S. NAVAL COMBAT SYSTEMS (STUDY REPORT
PMC 73-1). FORT BELVOIR, VIRGINIA: DEFENSE SYSTEMS MANAGEMENT SCHOOL, MAY
1973. (NTIS NO. AD A045265)
DESCRIPTION:

A DISTINCT TREND IN THE USE OF DIGITAL COMPUTERS IN U.S. NAVAL COMBAT SYSTEMS IS APPARENT. HOWEVER, THE COMPUTER REMAINS AN ALIEN MEMBER OF THE SYSTEM, A SITUATION DESCRIBED AS PRESENT SHOCK. THIS REPORT IS AN ATTEMPT TO IDENTIFY AND CURE THE CAUSES OF PRESENT SHOCK. AN AUTOMATED COMBAT SYSTEM MODEL WAS CONSTRUCTED AND USED AS A CONTROL DEVICE AGAINST WHICH REAL-WORLD COMBAT SYSTEMS WERE COMPARED. DATA COMPARISONS INDICATED THAT POOR MANAGEMENT PRACTICES WERE INTENSIFIED AS AUTOMATION WAS INCREASED. THE ACTIONS RECOMMENDED TO ELIMINATE MANAGEMENT DEFICIENCIES INCLUDED: TRAINING IN PERCEPTION OF COMPUTERS AS SMALL GROUPS AND INDIVIDUAL MEMBERS OF COMBAT SYSTEMS, AND THE ESTABLISHMENT OF AN ORGANIZATIONAL CLIMATE IN WHICH THE ROLE OF COMPUTERS IS WELL DIFFERENTIATED AND SIMULTANEOUSLY WELL INEGRATED IN COMBAT SYSTEMS. (A) 78P, 15R.

COMMENTS:

THIS IS A VERY HIGH LEVEL DISCUSSION OF USER ACCEPTANCE AND THE PERFORMANCE OF MAN-MACHINE SYSTEMS. THE "AUTOMATED COMBAT SYSTEM MODEL" DISCUSSED IN THIS PAPER IS A LARGELY ACADEMIC EXERCISE IN DEFINING AN IDEAL COMBAT SYSTEM. THIS DISCUSSION WOULD NOT, THEREFORE, BE RELEVANT TO THOSE INVOLVED IN THE DESIGN OF SUCH SYSTEMS. THE AUTHOR DOES, HOWEVER, PRESENT A SUMMARY OF THE OVERALL PERFORMANCE OF COMPUTERIZED COMBAT SYSTEMS. THE FACT THAT IN 186 TARGET TRACKING EXERCISES, FOR EXAMPLE, ONLY 11 CASES WERE IDENTIFIED WHERE ALL EXERCISES WERE SATISFACTORILY COMPLETE CLEARLY INDICATES THAT THE COMBAT SYSTEMS INVOLVED ARE INADEQUATE. THE PROPOSED SOLUTIONS INVOLVE USER ACCEPTANCE AND BETTER MANAGEMENT PRACTICES. WHILE THESE SUGGESTIONS MAY WELL BE USEFUL, THE AUTHOR APPEARS TO IGNORE THE VERY REAL POSSIBILITY THAT A MAJOR PROBLEM IN COMBAT SYSTEMS IS DUE TO THE ACTUAL DESIGN AND IMPLEMENTATION OF THESE SYSTEMS.

337 USE OF TELEPHONE AS DATA ENTRY DEVICE MILLER, I. HOUSEWIVES' PERFORMANCE WITH A COMPUTER-BASED PRODUCT SALES INFORMATION SYSTEM (TECHNICAL REPORT TR54.050). BOCA RATON, FLORIDA: IBM GENERAL SYSTEMS DIVISION, JULY, 1974 (ALSO REPORTED BRIEFLY IN HUMAN FACTORS, 1977, 19, 201-203).

A HUMAN FACTORS STUDY WAS MADE OF AN EXPERIMENTAL PRODUCT SALES INFORMATION SYSTEM THAT PERMITS HOUSEWIFE PANELISTS TO TRANSMIT NUMERICALLY ENCODED ENTRIES DESCRIPTIVE OF THEIR PURCHASES OF SPECIFIED NONDURABLE PRODUCTS TO A

TWENTY WOMEN PERFORMED ENCODING AND TRANSMISSION TRIALS OVER A FIVE DAY PERIOD WITH AN EXPERIMENTAL VERSION OF THE SYSTEM. ENCODED TRANSMISSIONS PERIOD WITH AN EXPERIMENTAL VERSION OF THE SYSTEM. ENCODED TRANSMISSIONS WERE MANUALLY KEYED FROM A 12-KEY TELEPHONE HAND SET. AS MEASURED ON THE FINAL TRIAL, ACCURACY OF ENCODING AND SYSTEM-ACCEPTABILITY OF TRANSMITTED ENTRIES WAS VERY HIGH: FOR TRANSMISSIONS REPRESENTING 10 PRODUCT CATEGORIES, 98.9% OF THE ENTRIES WERE ACCEPTABLE AND ACCURATE, FOLLOWING ON-LINE ERROR CHECKS AND ONE OPPORTUNITY TO RE-KEY REJECTED ENTRIES; FOR TRANSMISSION OF 20 PRODUCT CATEGORIES THE CORRESPONDING VALUE WAS 97.9%.

MEAN DURATIONS ATTAINED FOR THE TRANSMISSION WERE 7.5 MINUTES FOR 10 PRODUCT CATEGORIES; 14.1 MINUTES FOR 20 PRODUCT CATEGORIES. SUGGESTIONS ARE OFFERED FOR REDUCING THESE TRANSMISSION DURATIONS SUBSTANTIALLY. (A)

28P, 3R.

COMMENTS:

DESCRIPTION:

ALTHOUGH THIS STUDY MAY, AS THE AUTHOR CLAIMS, INDICATE THE FEASIBILITY OF TRANSMITTING PRODUCT SALES INFORMATION VIA A TELEPHONE HAND SET, IT IS NOT AN ADEQUATE EMPIRICAL STUDY FOR MORE GENERAL PURPOSES. FOR EXAMPLE, THE AUTHOR REFERS TO "EXPERIMENT 1" AND "EXPERIMENT 2" WHICH ACTUALLY CONSTITUTE A SINGLE, INCOMPLETE FACTORIAL DESIGN. THE FIRST "EXPERIMENT" COMPARED CODED AND WRITTEN FORMS OF PRODUCT INFORMATION ENCODING AND FOUND NO SIGNIFICANT DIFFERENCES. THE SECOND "EXPERIMENT" INVOLVED THE TRANSMISSION OF CODED INFORMATION. ALTHOUGH OBSERVED ACCURACY WAS VERY HIGH, NO COMPARISONS CAN BE MADE WITH ALTERNATIVE ENCODING AND TRANSMISSION PROCEDURES. THIS PAPER DOES, HOWEVER, CONTAIN POTENTIALLY USEFUL INFORMATION ON THE USE OF TELEPHONES AS COMPUTER TERMINALS AND WOULD BE RELEVANT TO ANYONE INTERESTED IN THIS TOPIC.

338 PROGRAMMING AND QUERY LANGUAGE PROPERTIES
MILLER, L.A. PROGRAMMING BY NON-PROGRAMMERS. INTERNATIONAL JOURNAL OF
MAN-MACHINE STUDIES, 1974, 6, 237-260 (ALSO: RESEARCH REPORT RC-4280, IBM
WATSON RESEARCH CENTER, YORKTOWN HEIGHTS, NY, 1973).
DESCRIPTION:

NON-PROGRAMMERS WERE ASKED TO ORGANIZE NATURAL ENGLISH COMMANDS OF A LABORATORY PROGRAMMING LANGUAGE INTO PROGRAMS FOR SOLVING NAME-SORTING PROBLEMS. THE PROBLEMS DIFFERED IN THE SORT CONCEPT TO BE PROGRAMMED (CONJUNCTION VS. DISJUNCTION) AND IN THE FORM OF EXPRESSION OF THE LETTER TESTS TO BE MADE ON THE NAMES (AFFIRMATION VS. NEGATION).

PROGRAMMING PERFORMANCE WAS FOUND TO BE IMPAIRED WITH DISJUNCTIVE CONCEPTS AND WITH LETTER TESTS INVOLVING NEGATION. DIFFERENT CLASSES OF PROGRAM STRUCTURE WERE IDENTIFIED AND WERE ASSOCIATED WITH CERTAIN PROBLEM CONDITIONS AND ERROR MEASURES. AM INFLUENCE OF PRIOR EXPERIENCE WITH PROCEDURES ON PERFORMANCE WAS SUGGESTED. PROGRAM DEBUGGING AND TESTING PERFORMANCE WAS CHARACTERIZED. (A)

#### COMMENTS:

THIS IS AN EXCELLENT STUDY. IT ILLUSTRATES THE USE OF A SMALL "LABORATORY" PROGRAMMING LANGUAGE AS A MEDIUM FOR PSYCHOLOGICAL STUDIES IN THIS AREA (SEE ALSO M.E. SIME, T.R.G. GREEN, & D.J. GUEST, 1973). THE EXPERIMENT VERIFIES THAT A PRIOR FINDING DUTSIDE THE SOFTWARE AREA -- LOOSELY, THAT DISJUNCTION AND NEGATION RESULT IN POORER COMPREHENSION -- APPLIES ALSO TO THE CORRESPONDING PROGRAMMING, AND PERHAPS QUERY, TASKS, AND IT INDICATES HOW THESE CONCEPTS RESULT IN ERRORS IN THE CONTROL STRUCTURES OF THE GENERATED PROGRAMS. THE STUDY THUS PROVIDES A SMALL MEASURE OF BASIC INSIGHT INTO PROGRAMMING BEHAVIOR. THE IMPLICATIONS OF THIS KNOWLEDGE FOR PROGRAMMING PRACTICES IS NOT IMMEDIATELY CLEAR, HOWEVER -- A COMMON FRUSTRATION OF BASIC RESEARCH. FOR EXAMPLE, IT IS NOT CLEAR FROM THIS STUDY WHETHER OR NOT DISJUNCTION AND NEGATION WOULD BE A PROBLEM IF THE PROGRAMMING OR QUERY LANGUAGE IN USE ALLOWED DISJUNCTIVE BOOLEAN EXPRESSIONS WITH NEGATIVE TERMS. THE STUDY OF PROGRAMMING BEHAVIOR USING NONPROGRAMMER SUBJECTS ALSO IMPOSES CERTAIN LIMITATIONS ON GENERALITY, AT LEAST UNTIL WE KNOW BETTER THE EFFECTS OF EXPERIENCE (AND PERHAPS SELECTION) ON PROGRAMMER BEHAVIOR. THIS IS, NONETHELESS, A VERY GOOD EXPERIMENT, ANALYZED AND REPORTED IN A CLEAR AND INFORMATIVE MANNER.

339 SPECIFICATION OF PROCEDURES IN NATURAL LANGUAGE
MILLER, L.A., & BECKER, C.A. PROGRAMMING IN NATURAL ENGLISH (TECHNICAL REPORT
NO. RC-5137). YORKTOWN HEIGHTS, NEW YORK: IBM WATSON RESEARCH CENTER, NOVEMBER
1974. (NTIS NO. AD A003923)
DESCRIPTION:

COLLEGE STUDENTS WERE ASKED TO TYPE DETAILED SPECIFICATIONS OF PROCEDURES IN THEIR NATURAL LANGUAGE (ENGLISH) AS SOLUTIONS FOR A SET OF SIX FILE MANIPULATION PROBLEMS. THE LANGUAGE PRODUCTIONS WERE EXAMINED FROM THE POINTS OF VIEW OF SOLUTION CORRECTNESS, PREFERENCES OF EXPRESSIONS, CONTEXTUAL REFERENCING, WORD USAGE, AND FORMAL PROGRAMMING LANGUAGES. (A) AMONG OTHER RESULTS, SOLUTIONS WERE GENERALLY SATISFACTORY ONLY FOR THE SIMPLEST PROBLEMS; FOR MORE COMPLEX PROBLEMS, SOLUTIONS TENDED TO BE INCOMPLETE. SUBJECTS TENDED TO SELECT THE SIMPLEST OF THE AVAILABLE ALGORITHMS; THESE WERE NOT NECESSARILY THE MOST EFFICIENT OR THE LEAST ERROR-PROBLE APPROACHES. FORTY-TWO PERCENT OF THE DATA REFERENCES WERE CONTEXT-DEPENDENT. SUBJECTS TENDED TO TREAT DATA AGGREGATES, RATHER THAN INDIVIDUAL DATA ELEMENTS. LITTLE EXPLICIT TRANSFER OF CONTROL OCCURRED; THE PROCEDURES WERE MOSTLY LINEAR.

#### 58P, 38R. COMMENTS:

THIS IS AN INTERESTING APPROACH TO UNDERSTANDING NOW PEOPLE SPECIFY PROCEDURES. THE AUTHORS' ANALYSIS PROVIDES USEFUL INSIGHT INTO SOME ASPECTS OF THE ALGORITHM DESIGN AND SPECIFICATION PROCESS, BUT THE USE OF ONLY NONPROGRAMMER PERSONNEL SOMEWHAT RESTRICTS THE GENERALITY OF THE RESULTS. THE STUDY RAISES, BUT DOES NOT SETTLE, SEVERAL ISSUES IN PROGRAMMING LANGUAGE AND QUERY LANGUAGE DESIGN. FOR EXAMPLE, THESE SUBJECTS APPARENTLY FOUND CONTEXTUAL REFERENCING MATURAL, AND IT IS CONCEIVABLE THAT THE PROVISION OF CAPABILITIES FOR SUCH REFERENCES IN PROGRAMMING AND QUERY LANGUAGES WOULD MAKE THEM EASIER TO USE. THAT MIGHT BE TRUE ONLY FOR NOMPROGRAMMERS, HOWEVER. IT WOULD BE INTERESTING TO COMPARE THESE RESULTS WITH THOSE OF A SIMILAR EXPERIMENT UTILIZING EXPERIENCED PROGRAMMERS.

340 GENERAL DISCUSSION OF ISSUES IN MAN-COMPUTER INTERACTION MILLER, L.A., & THOMAS, J.C., JR. BEHAVIORAL ISSUES IN THE USE OF INTERACTIVE SYSTEMS (TECHNICAL REPORT NO. RC-6326). YORKTOWN HEIGHTS, NEW YORK: IBM WATSON RESEARCH CENTER, DECEMBER 1976. DESCRIPTION:

THIS PAPER IDENTIFIES BEHAVIORAL ISSUES RELATED TO THE USE OF INTERACTIVE COMPUTERS PRIMARILY BY PERSONS WHO ARE NOT COMPUTER PROFESSIONALS, SO-CALLED "GENERAL USERS." THIS IS NOT AN EXHAUSTIVE LITERATURE SURVEY, BUT INSTEAD PROVIDES: (1) A STRUCTURE FOR DISCUSSING ISSUES OF INTERACTIVE COMPUTING, AND (2) THE AUTHORS' BEST ESTIMATE OF IMPORTANT BEHAVIORAL PROBLEMS, WITH SUGGESTIONS FOR SOLUTIONS.

THE DISCUSSION IS LIMITED IN THIS PAPER TO GENERAL ISSUES WHICH DO NOT TAKE INTO ACCOUNT THE USER'S PARTICULAR TASK. THE TWO MAJOR TOPICS ARE SYSTEM CHARACTERISTICS (PERFORMANCE, FACILITIES, AND ON-LINE INFORMATION), AND INTERFACE CHARACTERISTICS (DIALOGUE SYTLE, DISPLAYS AND GRAPHICS, OTHER INPUT/OUTPUT MEDIA). (A)

COMMENTS:

THIS BRIEF, VERY READABLE PAPER COULD SERVE AS A USEFUL OVERVIEW OF THE GENERAL AREA OF HUMAN FACTORS IN INTERACTIVE SYSTEMS FOR THOSE WHO ARE UNFAMILIAR WITH THIS AREA. APPROXIMATELY TWO DOZEN TOPICS OF CURRENT INTEREST ARE IDENTIFIED AND THE UNDERLYING BEHAVIORAL ISSUES ARE BRIEFLY CONSIDERED FOR EACH TOPIC. ALTHOUGH DETAILED GUIDELINES FOR THE DESIGN OF INTERACTIVE SYSTEMS ARE NOT PRESENTED, THIS PAPER IS A GOOD SOURCE OF SECONDARY REFERENCES FOR THOSE INTERESTED IN PURSUING ANY OF THE CONSIDERED TOPICS IN MORE DETAIL. READERS MORE FAMILIAR WITH RESEARCH ON HUMAN FACTORS IN INTERACTIVE SYSTEMS MAY CRITICIZE THE PRESENTED TAXONOMY OF THIS RESEARCH AS INCOMPLETE OR AS LACKING SUFFICIENT DETAIL. THIS TAXONOMY MAY, HOWEVER, BE A GOOD STARTING POINT FOR THE DEVELOPMENT OF MORE EXTENSIVE CHARACTERIZATIONS WHICH MAY, IN TURN, LEAD TO THE DEVELOPMENT OF A USEFUL HANDBOOK TO AID THE DESIGNER OF INTERACTIVE SYSTEMS.

341 MAN-COMPUTER PROBLEM SOLVING
MILLER, R.B. PSYCHOLOGY FOR A MAN-MACHINE PROBLEM-SOLVING SYSTEM (TECHNICAL
REPORT TROO.1246). POUGHKEEPSIE, NEW YORK: IBM CORP., FEBRUARY 1965 (ALSO IN
L. THAYER (ED.), COMMUNICATION THEORY AND RESEARCH: PROCEEDINGS OF THE FIRST
INTERNATIONAL SYMPOSIUM: SPRINGFIELD, ILLINOIS: CHARLES C. THOMAS, 1967,
310-347). (NTIS NO. AD 640283)
DESCRIPTION:

THIS PAPER DEALS WITH THE USE OF COMPUTER CAPABILITIES TO EXTEND HUMAN CAPABILITIES FOR INVENTION AND DISCOVERY. A PROGRAMMATIC ROUTE WILL BE PROPOSED FOR DEVELOPMENT. THE FIRST STAGE IN THIS ROUTE WILL BE AN ANALYTIC ENUMERATION OF HUMAN ABILITIES AND LIABILITIES AS A PROBLEM-SOLVING MECHANISM. THE SECOND STAGE WILL DEAL WITH AN ANALYSIS OF HUMAN INFORMATION-HANDLING TASKS. THESE TWO STAGES SHOULD ILLUMINATE SYSTEM OBJECTIVES, WHILE AT THE SAME TIME OPTIONS FOR DESIGNING THE MAN-MACHINE PROBLEM-SOLVING ENTITY BECOME CLARIFIED. THE RESULT WILL BE AN INTELLIGENCE-RETRIEVAL SYSTEM COMBINED WITH LOGICAL AND EXTRAORDINARY DISPLAY CAPABILITIES. THE PRINCIPAL DESIGN ISSUES WILL BE REVEALED AS INDEXING CONTENT AND STRUCTURE AND DISPLAY SYMBOLOGIES. AN IMPORTANT (AND NEGLECTED) DIMENSION IN SYSTEM DESIGN IS THE HUMAN'S ABILITY TO LEARN AND THINK IN NEW LANGUAGES AND SYMBOLOGIES. (A)

COMMENTS:

ALTHOUGH THIS PAPER IS SOMEWHAT DATED, IT DOES CONTAIN SOME INTERESTING AND USEFUL IDEAS. THE AUTHOR PRESENTS AN EASY TO READ DISCUSSION OF THE 'ABILITIES AND LIMITATIONS OF HUMAN PROBLEM SOLVERS. THIS IS, OF COURSE, A NECESSARY STEP IN DEVELOPING EFFECTIVE MAN-COMPUTER PROBLEM SOLVING SYSTEMS. A MORE THOROUGH UNDERSTANDING OF THE COGNITIVE PROCESSES AND STRUCTURES THAT UNDERLY THESE ABILITIES AND LIMITATIONS COULD BE VERY BENEFICIAL, BUT SUCH AN ANALYSIS IS NOT ATTEMPTED IN THIS PAPER. THE TASK TAXONOMY PROPOSED ON THIS PAPER WAS EXPANDED BY R.B. MILLER (1969) AND THE READER INTERESTED IN THIS TOPIC IS REFERRED TO THE LATTER PAPER.

EFFECT OF SYSTEM RESPONSE TIME ON USER MILLER, R.B. RESPONSE TIME IN MAN-COMPUTER CONVERSATIONAL TRANSACTIONS. AFIPS CONFERENCE PROCEEDINGS, 1968, 33(PT. 1), 267-277. DESCRIPTION:

IN TERMS OF CONVERSATIONAL INTERACTION AND SUSTAINED THINKING, AS IN INTERACTIVE PROBLEM SOLVING, DELAYS AND INTERRUPTIONS OF EVEN A FEW SECONDS MAY BE HIGHLY SIGNIFICANT, WHEREAS MUCH LONGER DELAYS ARE TOLERABLE UNDER APPROPRIATE CONDITIONS. AN ANALYSIS OF INTERACTIVE COMPUTER SYSTEM RESPONSE DELAYS IS PRESENTED. EFFECTS OF RESPONSE DELAY ON CONVERSATIONAL INTERACTION, SUSTAINED IDEATION, SHORT-TERM MEMORY, AND USER MOTIVATION ARE CONSIDERED, WITH RESULTING IMPLICATIONS FOR SYSTEM ACCEPTANCE AND PROBLEM-SOLVING EFFICACY. SEVENTEEN CATEGORIES OF USER INQUIRY ARE ANALYZED, WITH CONCLUSIONS CONCERNING ACCEPTABLE DELAYS FOR EACH. ACCEPTABLE DELAYS FOR THESE VARIOUS INQUIRY CATEGORIES RANGE FROM 0.1 SECONDS TO SEVERAL MINUTES, DEPENDING ON THE PHASE OF PROBLEM SOLVING IN WHICH THE USER IS ENGAGED AND THE NATURE OF THE INFORMATION REQUESTED.

11P, 5R.

COMMENTS:

THIS IS AN EXCELLENT DISCUSSION OF RESPONSE-TIME CONSIDERATIONS IN MAN-COMPUTER DIALOGUE. THE MAJOR CONTRIBUTION OF THE PAPER IS ITS RECOGNITION THAT THE COST OF INCREASING DELAYS MAY BE A STEP FUNCTION, RATHER THAN CONTINUOUS. THUS, A SYSTEM WHOSE RESPONSE TIME PROPERTIES ARE ALMOST GOOD ENOUGH MAY NOT BE ACCEPTABLE AT ALL. THE PAPER IS LARGELY ANALYTICAL; TO THE EXTENT THAT IT HAS AN IDENTIFIABLE BASIS IN EMPIRICAL RESEARCH, THAT RESEARCH IS PRIMARILY CONCERNED WITH INTERPERSONAL DIALOGUE AND WITH NON-COMPUTER-RELATED TEMPORAL EFFECTS STUDIES, RATHER THAN WITH EXPLICIT STUDIES OF MAN-COMPUTER DIALOGUE. THE AUTHOR, THEREFORE, IDENTIFIES HIS COMMENTS ON ACCEPTABLE RESPONSE TIMES FOR VARIOUS TASKS AS SPECULATIONS, RATHER THAN ESTABLISHED FACT. IN RETROSPECT, THESE SPECULATIONS STILL APPEAR REASONABLY GOOD, AND THE CONCERNS AND GENERAL PHILOSOPHY CERTAINLY REMAIN VALID TODAY.

IF A FIELD SO YOUNG CAN HAVE PAPERS WHICH ARE "CLASSICS," THIS IS CLEARLY ONE OF THEM. THE DISCUSSION WOULD BENEFIT ALMOST ANYONE CONCERNED WITH INTERACTIVE SYSTEMS.

TASKS IN MAN-COMPUTER PROBLEM SOLVING 343 MILLER, R.B. ARCHETYPES IN MAN-COMPUTER PROBLEM SOLVING. ERGONOMICS, 1969, 12, 559-581.

DESCRIPTION:

INFORMATION SYSTEMS APPLIED TO OPERATIONAL ENVIRONMENTS HAVE MEANING ONLY IN WHAT THEY DO FOR HUMANS PERFORMING TASKS, WHETHER CLERICAL, TECHNICAL OR MANAGERIAL. EACH PERSON'S JOB-POSITION ENTAILS INTERACTION WITH A LIMITED SET OF CATEGORIES OF VARIABLE DATA. BY "LIMITED" IS MEANT LESS THAN SEVERAL THOUSAND, AND MORE LIKELY SEVERAL HUNDRED, CATEGORIES. A CATEGORY SET ASSOCIATED WITH A COLLECTION OF TASKS PERFORMED BY AN INDIVIDUAL OR AN ORGANIZATION MAY BE CALLED A CATEGORY DOMAIN. THIS CONCEPT MAKES POSSIBLE PRACTICABLE (IN SIZE) DATA BASE RESPONSIVE TO SUPPORT HUMAN TASKS IN HUMAN (PSYCHOLOGICAL) TIME. THIS CONCEPT MAKES POSSIBLE A

AN ANALYSIS OF HUMAN PROBLEM-SOLVING TASKS REVEALS THE FOLLOWING GAMUT: SIMPLE INQUIRY AND UPDATE, STATUS INQUIRY, BRIEFING, EXCEPTION DETECTION, DIAGNOSIS, PLANNING/CHOOSING, EVALUATING/OPTIMIZING, CONSTRUCTING (DESIGNING), AND DISCOVERY. THERE IS NO COMPULSIVE ORDERING OF THESE ON A COMPLEXITY SCALE. THE INFORMATION PROCESSING STRUCTURE OF EACH IS EXAMINED: SOME COMMON DENOMINATORS AMONG THIS SET REVEAL FIVE UNDERLYING ARCHETYPES OF BY MAKING THESE ARCHETYPES EXPLICIT AND CONSISTENT WITH CONCEPTS OF DOMAIN, APPLICATION DISCIPLINES AND SYSTEM DESIGN CAN MOVE IN PARALLEL AND GENERATE A SIMPLE, WELL-DEFINED LANGUAGE STRUCTURE BETWEEN SYSTEM AND HUMAN USER. (A)

23P, 12R.

COMMENTS:

THE AUTHOR OF THIS PAPER PRESENTS TWO INTERESTING ARGUMENTS. THE FIRST IS THAT A PRINCIPAL PROBLEM WITH CENTRALIZED DATA BASES IS THAT EACH USER MUST ACTIVELY DEFINE AND REQUEST THE INFORMATION HE NEEDS. HE FURTHER ARGUES THAT A PARTICULAR TASK DEFINES ONE OR MORE "INFORMATION DOMAINS" AND, IF WE COULD DEVELOP A TAXONOMY OF TASKS AND THEIR ASSOCIATED INFORMATION REQUIREMENTS, WE COULD STRUCTURE INFORMATION TO BE COMPATIBLE WITH EACH TASK. THE AUTHOR THEN PROCEEDS TO DESCRIBE A TAXONOMY OF MAN-COMPUTER PROBLEM SOLVING TASKS. ALTHOUGH THIS MAY BE A VALID CATEGORIZATION OF PROBLEM SOLVING TASKS, IT FAILS TO ADEQUATELY DESCRIBE HOW THESE TASKS DIFFER; THAT IS, WHAT COGNITIVE PROCESSES AND STRUCTURES ARE INVOLVED IN THESE DIFFERENT TASKS. NEVERTHELESS, THIS IS A WELL-WRITTEN PAPER AND IT MAY BE OF USE IN DEVELOPING A MORE SOPHISTICATED TAXONONY.

ANNUAL REVIEW ON MAN-COMPUTER INTERACTION

MILLS, R.G. MAN-MACHINE COMMUNICATION AND PROBLEM SOLVING. IN C.A. CUADRA (ED.), ANNUAL REVIEW OF INFORMATION SCIENCE AND TECHNOLOGY (VOL. 2), NEW YORK: WILEY, 1967, 223-254.

DESCRIPTION:

A REVIEW OF THE 1966 LITERATURE RELATED TO SYSTEMS FOR MAN-MACHINE COMMUNICATION AND APPLICATIONS IS PRESENTED. TOPICS CONSIDERED INCLUDE DATA COMMUNICATION, TERMINAL DEVICES, INTERACTIVE LANGUAGES, COMPUTER-ASSISTED INSTRUCTION, DATA BASE MANAGEMENT AND RETRIEVAL SYSTEMS, AND AIDS TO HUMAN CREATIVITY. 109R. 32P,

COMMENTS:

THE "ANNUAL REVIEW" CHAPTERS GENERALLY PRESENT GOOD, HIGH-LEVEL REVIEWS OF THE FIELD OF MAN-COMPUTER INTERACTION AND ARE VERY GOOD SOURCES FOR THOSE WHO WISH TO TRACE DEVELOPMENTS AND VIEWPOINTS IN THIS AREA. THE PRESENT REVIEW INDICATES THE TRANSITION BETWEEN CONCERN WITH DEVELOPING TIME-SHARING SYSTEMS TO CONCERN WITH EFFECTIVELY USING SUCH SYSTEMS. IN THIS TIME PRAME, DEVELOPMENT OF USER-DRIENTED SUBSYSTEMS WAS BEGINNING. THIS PAPER WOULD BE A GOOD SOURCE FOR THOSE WITH A GENERAL, HISTORICAL INTEREST IN THE AREA OF MAN-COMPUTER INTERACTION, BUT WOULD NOT BE RELEVANT TO THOSE SEEKING MORE TECHNICAL INFORMATION.

345 MAN-COMPUTER PROBLEM SOLVING IN DIAGNOSTIC TASKS
MILLS, R.G. A STRUCTURE OF MAN-MACHINE DIAGNOSTIC INFORMATION SYSTEMS:
IMPLICATIONS FOR HUMAN ENGINEERING RESEARCH AND DESIGN (TECHNICAL REPORT
AMRL-TR-68-134). WRIGHT-PATTERSON AFB, OHIO: AEROSPACE MEDICAL RESEARCH
LABORATORY, DECEMBER 1968. (NTIS NO. AD 689766)
DESCRIPTION:

A CONCEPTUAL FRAMEWORK FOR DESCRIBING AND ANALYZING MAN-MACHINE DIAGNOSTIC SYSTEMS (E.G., MAINTENANCE AND CHECK-OUT, COMMAND AND CONTROL SYSTEMS) IS SUGGESTED. EMPHASIS IS PLACED ON "INFORMATION", ITS NATURE AND ITS FLOW WITHIN SUCH SYSTEMS. THE MORE PROMINENT VARIABLES AFFECTING DIAGNOSTIC PROCESSES AND PERFORMANCE (I.E., INFERENTIAL DECISION-MAKING) AND THEIR TOPOLOGICAL INTERRELATIONSHIPS ARE DESCRIBED. A GRAPHIC REPRESENTATION OF THE PROCESSES INVOLVED IN THESE SYSTEMS IS PROVIDED IN TERMS OF A GENERALIZED FLOW DIAGRAM. INFORMATION PARAMETERS ARE CRITICAL IN DETERMINING THE QUALITY OF DIAGNOSTIC PERFORMANCE IN MAN-MACHINE DIAGNOSTIC SYSTEMS. IT IS CONCLUDED THAT RESEARCH CONCERNING THE RELATIONSHIPS BETWEEN INFORMATION PARAMETERS AND DIAGNOSTIC PERFORMANCE, AS WELL AS THE MORE TRADITIONAL (I.E., DISPLAY/CONTROL) RESEARCH, IS REQUIRED TO DEVELOP HUMAN ENGINEERING CRITERIA APPLICABLE TO THE DESIGN OF DIAGNOSTIC SYSTEMS. SEVERAL EXAMPLES OF RELEVANT HUMAN ENGINEERING RESEARCH PROBLEMS ARE DISCUSSED. (A) 14P, 25R.

COMMENTS:

THIS PAPER PRESENTS A CONCEPTUAL FRAMEWORK THAT FOCUSES ON THE NATURE AND FLOW OF INFORMATION IN DIAGNOSTIC SYSTEMS SUCH AS THOSE FOR AUTOMATED CHECKOUT OR COMMAND AND CONTROL. ALTHOUGH THE AUTHOR PRESENTS A REASONABLE TAXONOMY OF DIAGNOSTIC TASKS, THIS TAXONOMY IS NOT BROAD ENOUGH TO INCLUDE THE VAST VARIETY OF TASK ENVIRONMENTS THAT CONFRONT HUMAN PROBLEM SOLVERS AND THAT COULD BENEFIT FROM THE APPLICATION OF MAN-COMPUTER PROBLEM-SOLVING SYSTEMS. THIS PAPER WOULD BE OF INTEREST TO THOSE CONCERNED WITH MAN-COMPUTER PROBLEM SOLVING IN DIAGNOSTIC SYSTEMS.

346 USER REQUIREMENTS ANALYSIS

MJOSUND, A. TOWARD A STRATEGY FOR INFORMATION NEEDS ANALYSIS. COMPUTERS AND OPERATIONS RESEARCH, 1975, 2, 39-47.
DESCRIPTION:

INFORMATION NEEDS ANALYSIS IS A PREREQUISITE FOR DESIGN OF AN EFFECTIVE INFORMATION SYSTEM. HOWEVER, THE PROBLEMS ASSOCIATED WITH SUCH ANALYSIS HAVE BEEN LARGELY NEGLECTED IN THE INFORMATION SYSTEMS LITERATURE. TWO SIMULTANEOUS GENERAL APPROACHES ARE SUGGESTED WHICH ARE EXPECTED TO CONTRIBUTE TO THE SOLUTION OF THESE PROBLEMS. ONE IS TO USE THE INFORMATION SYSTEM ANALYSIS TO GUIDE RESEARCH, OR APPLICATION OF RESULTS FROM RESEARCH, TO SOLVE MANAGEMENT PROBLEMS. THE OTHER IS TO FOLLOW A STRATEGY IN THE ANALYSIS OF INFORMATION NEEDS SUCH THAT THE STEPS IN THIS ANALYSIS ARE CLOSELY RELATED TO THE STRUCTURE RELATING THE DECISIONS AND ACTIONS IN THE ORGANIZATION. A GROSS CLASSIFICATION SCHEME IS PROPOSED TO AID IN DETERMINING THE STRATEGY. (A)

9P, 7R.

THIS PAPER IS BASED ON THE PREMISE THAT USER INFORMATION REQUIREMENTS ANALYSIS IS A NECESSARY PREREQUISITE FOR THE DESIGN OF INFORMATION SYSTEMS. THE AUTHOR MAKES SEVERAL SUGGESTIONS THAT, ALTHOUGH SPECULATIVE AND UNTESTED, MAY BE USEFUL IN DETERMINING INFORMATION REQUIREMENTS. FOR EXAMPLE, THE AUTHOR PROPOSES THAT INFORMATION CAN BE CLASSIFIED ALONG TWO DICHOTOMOUS DIMENSIONS, PRIMARY-SUPPORTIVE AND OPERATIVE-DIRECTIVE. THIS IS THEN USED TO INDICATE THE RELATIVE IMPORTANCE OF EACH TYPE OF INFORMATION. IT REMAINS TO BE DEMONSTRATED, HOWEVER, THAT SUCH A CLASSIFICATION CAN BE MADE. A SIMILAR SUGGESTION INVOLVES THE ANALYSIS OF INDIVIDUAL INFORMATION SYSTEMS AS VARIATIONS OF STANDARDIZED SYSTEMS, AS YET UNDEFINED. ALTHOUGH THIS PAPER WOULD NOT BE RELEVANT TO THOSE DESIRING FORMAL GUIDELINES FOR USER REQUIREMENTS ANALYSIS, IT CONTAINS SEVERAL IDEAS THAT SHOULD BE OF INTEREST TO THOSE CONCERNED WITH DEVELOPING AND TESTING SUCH GUIDELINES.

347 COGNITIVE STYLE AS RELATED TO PERSONALIZED SYSTEMS
MODRICK, J.A., LEVIT, R.A., ALDEN, D.G., & HENKE, A.H. REVIEW OF APPROACHES TO
COGNITIVE STYLE AND IMPLICATIONS FOR HUMAN INFORMATION PROCESSING IN COMMAND
AND DECISION SITUATIONS. IN PROCEEDINGS, HUMAN FACTORS SOCIETY, 19TH ANNUAL
MEETING. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1975, 333-335.
DESCRIPTION:

THE MEANING OF THE TERM COGNITIVE STYLE AND THE MAJOR EXPERIMENTAL APPROACHES ARE REVIEWED. A MODEL AND MEASURE USED IN DECISION AIDING IS PRESENTED. METHODOLOGICAL PROBLEMS ARE DISCUSSED. (A) 3P, 15R.

COMMENTS:

COGNITIVE STYLE IS A CONCEPT THAT IS OF CENTRAL IMPORTANCE TO THE RESEARCH BEING CONDUCTED BY LEVIT AND HIS COLLEAGUES ON DECISION AIDS FOR THE ARMY'S SIMULATED TACTICAL OPERATIONS SYSTEM (SINTOS). THE AUTHORS VERY BRIEFLY REVIEW A VARIETY OF CONCEPTS THAT MAY BE RELEVANT TO COGNITIVE STYLE AND THEN PROPOSE THEIR OWN DEFINITION. IF A CONCEPT IS THOUGHT TO BE IMPORTANT IN A RESEARCH PROGRAM, DISREGARDING PREVIOUSLY USED AND VALIDATED DEFINITIONS IN FAVOR OF A NOVEL DEFINITION CAN LEAD TO OBVIOUS PITFALLS. THIS IS ESPECIALLY TRUE FOR CONCEPTS THAT ARE, IN GENERAL, RATHER ILL—DEFINED AND NOT SUBJECT TO EASY EMPIRICAL VALIDATIONS. R.A. LEVIT, B.J. HEATON, AND D.G. ALDEN (1975) MAKE EXTENSIVE USE OF THIS CONCEPT IN FORMULATING DECISION AIDS FOR SIMTOS. THE GENERAL LACK OF SIGNIFICANT FINDINGS IN THEIR RESEARCH MAY BE DUE TO THE DEFINITION OF COGNITIVE STYLE USED OR, QUITE POSSIBLY, DUE TO THE FACT THAT COGNITIVE STYLE, REGARDLESS OF HOW IT IS DEFIMED, IS MOT A RELEVANT CONCEPT. A BETTER UNDERSTANDING OF BASIC HUMAN PROBLEM—SOLVING SKILLS AND TECHNIQUES WOULD APPEAR TO BE A MORE USEFUL EMPHASIS, AT LEAST FOR THE INITIAL DEVELOPMENT OF DECISION AIDS.

34B NATURAL LANGUAGE AS A QUERY LANGUAGE
MONTGOMERY, C.A. IS NATURAL LANGUAGE AN UNNATURAL QUERY LANGUAGE?
PROCEEDINGS OF THE ASSOCIATION FOR COMPUTING MACHINERY, 1972, 1075-1078.
DESCRIPTION:

THE COMPLEX SYSTEM OF FORM/MEANING CORRELATIONS COMPRISING A NATURAL LANGUAGE PRESENTS A CONSIDERABLE CHALLENGE FOR AUTOMATED INTERPRETATION. IN ORDER TO DEAL WITH SUCH COMPLEXITY, ATTEMPTS AT AUTOMATED INTERPRETATION OF NATURAL LANGUAGE QUERIES HAVE TYPICALLY CONCENTRATED ON LIMITED SUBSETS OF NATURAL LANGUAGE. HOWEVER, SUCH SUBSETS ARE INEVITABLY ILL-DEFINED IN SOME WAY, ADDING ANOTHER CLASS OF INTERPRETIVE PROBLEMS TO BE WELL-KNOWN ONES OF SYNTACTIC AMBIGUITY AND UNGRAMMATICAL STRINGS. WHILE THE OTHER PROBLEMS ARE PRACTICALLY RESOLVABLE IN SOME SENSE, THE ABILITY OF AN AUTOMATED SYSTEM TO RESOLVE THE MANY SYNTACTIC AMBIGUITIES OF NATURAL LANGUAGE IS A FUNCTION OF THE INTERPRETIVE POWER OF THE LINGUISTIC MODEL UPON WHICH THE SYSTEM IS BASED. ALTHOUGH PREVIOUS MODELS HAVE LACKED THE INTERPRETIVE POWER TO DEAL WITH NATURAL LANGUAGE, A NOVEL APPROACH INTEGRATING THE TREATMENT OF FORM AND MEANING MAY PROVIDE AN EFFECTIVE BASIS FOR HANDLING NATURAL LANGUAGE AS AN INSTRUMENT OF COMMUNICATION IN AUTOMATED SYSTEMS. (A)

4P, 8R.

THIS PAPER DISCUSSES THE WELL-KNOWN PROBLEMS ASSOCIATED WITH ILL-DEFINED OR AMBIGUOUS SYSTEMS. VERY FEW USEFUL SUGGESTIONS FOR IMPROVING NATURAL-LANGUAGE QUERY SYSTEMS ARE OFFERED. MORE RECENT WORK IN ARTIFICIAL INTELLIGENCE HAS MADE SIGNIFICANT PROGRESS IN THIS AREA.

349 ENBEDDED TRAINING

MORRILL, C.S. COMPUTER-AIDED INSTRUCTION AS PART OF A MANAGEMENT INFORMATION SYSTEM. HUMAN FACTORS, 1967, 9, 251-256.
DESCRIPTION:

THIS PAPER DISCUSSES THE APPLICATION OF COMPUTER-AIDED INSTRUCTION AS PART OF A MANAGEMENT INFORMATION SYSTEM. THE COMPUTER PRESENTS DISPLAYS WHICH INSTRUCT THE STUDENT ON-LINE TO EXERCISE CONTROL OF THE COMPUTER SYSTEM USING A TYPEURITER OR A LIGHTPEN LOCATED AT THE CONSOLE WORK STATION. (A) THE INSTRUCTION IS DYNAMIC (OPERATIONS ARE PRACTICED IMMEDIATELY ON-LINE) BUT NOT INTERACTIVE IN THE SENSE THAT AUTOMATIC PERFORMANCE EVALUATION AND CORRECTIVE GUIDANCE ARE PROVIDED. A HUMAN INSTRUCTOR IS PRESENT WHILE STUDENTS RECEIVE INSTRUCTION ON FIVE CONSOLES. FIFTEEN OF 2D STUDENTS WERE ABLE TO FINISH MOST, IF NOT ALL, OF A SET OF PRACTICE PROBLEMS DEALING WITH THE INSERTION, MODIFICATION, DELETION, AND TYPEWRITER LISTING OF TEXT DATA AFTER TWO HOURS' INSTRUCTION.

COMMENTS:

6P, 5R.

THIS IS ONE OF THE EARLIEST PAPERS DEALING WITH EMBEDDED TRAINING (USER TRAINING BY THE INTERACTIVE SYSTEM ITSELF). THE PAPER DESCRIBES AN APPROACH TO EMBEDDED TRAINING, WITHOUT MUCH DETAIL, AND PRESENTS SOME SUGGESTIVE EVIDENCE THAT IT WORKS. SUBSEQUENT EXPERIENCE WOULD SUGGEST THAT IT WORKS VERY WELL INDEED, IN CERTAIN SITUATIONS WITH CERTAIN USER CLASSES. THE DATA PRESENTED HERE ARE NOT CONVINCING BY THEMSELVES, THOUGH. THE STUDY DID NOT COMPARE COMPUTER-ASSISTED TRAINING WITH OTHER FORMS, AND IT IS DIFFICULT TO DETERMINE THE EFFECTIVENESS OF THE METHOD FROM AN ABSOLUTE COMPLETION RATE (15 OF 20 STUDENTS SUCCESSFULLY COMPLETED THE COURSE WITHIN TWO HOURS) WITHOUT MORE INFORMATION ABOUT THE NATURE AND DIFFICULTY OF THE TASK. THE IDEAS PRESENTED IN THE PAPER ARE GOOD, AND MAY HELP THOSE ATTEMPTING TO IMPLEMENT SUCH TECHNIQUES. IN PARTICULAR, THIS APPLICATION INCLUDED SEVERAL PRACTICE PROBLEMS INVOLVING FILE MANIPULATION USING THE SYSTEM. SUCH PRACTICE PROBLEMS SHOULD AID LONG-TERM RETENTION OF THE INFORMATION ACQUIRED DURING THE TRAINING. OVERALL, THIS PAPER POINTS THE WAY TO SOME PRACTICES WHICH ARE STILL NOT EMPLOYED AS WIDELY AS THEY PROBABLY SHOULD BE, AND PRESENTS USEFUL IDEAS ABOUT EMBEDDED TRAINING, BUT IS NOT CONVINCING AS AN EMPIRICAL STUDY.

350 COMPARISON OF INPUT MODALITIES

MORRILL, C.S., GOODWIN, N.C., & SMITH, S.L. USER INPUT MODE AND COMPUTER-AIDED INSTRUCTION. HUMAN FACTORS, 1968, 10, 225-232.

DESCRIPTION:

AN EVALUATION OF ON-LINE COMPUTER-AIDED INSTRUCTION WITHIN A MANAGEMENT INFORMATION SYSTEM COMPARED TYPEWRITER AND LIGHTPEN INPUT MODES AS STUDENTS LEARNED TO USE THE SYSTEM. THE FOLLOWING CONCLUSIONS WERE SUPPORTED: (1) COMPUTER-AIDED INSTRUCTION IS FEASIBLE IN A GENERAL-PURPOSE MANAGEMENT INFORMATION SYSTEM; (2) IT IS ALSO FEASIBLE TO DEMONSTRATE RETENTION OF LEARNED MATERIAL THROUGH COMPUTER-ADMINISTERED TESTS; (3) PROFESSIONAL TYPING SKILLS ARE NOT NECESSARY TO USE THE TYPEWRITER INPUT MODE EFFECTIVELY, PROVIDED THAT THE INPUTS REQUIRED ARE SHORT AND DIRECT; (4) IN THIS PARTICULAR SETTING THERE SEEMED TO BE EVIDENCE THAT THE TYPEWRITER WAS A MORE EFFECTIVE INPUT DEVICE THAN THE LIGHTPEN DURING THE INSTRUCTIONAL SEQUENCE, BUT THIS EVIDENCE IS QUESTIONABLE IN VIEW OF CONSIDERABLE INDIVIDUAL DIFFERNCES AMONG THE STUDENTS; (5) REGARDLESS OF PERFORMANCE, STUDENTS RESPONDED FAVORABLY TO THEIR EXPERIENCE WITH COMPUTER-AIDED INSTRUCTION. (A) 8P, 9R.

COMMENTS:

THE PRIMARY EMPHASIS IN THIS PAPER IS ON A COMPARISON OF LIGHTPEN AND KEYBOARD ENTRY IN THE CONTEXT OF EMBEDDED TRAINING. FOR A MORE DETAILED TREATMENT OF THE EMBEDDED TRAINING ASPECTS OF THE STUDY, SEE C.S. MORRILL (1967). UNFORTUNATELY, IT IS DIFFICULT TO DRAW USEFUL CONCLUSIONS FROM THE LIGHTPEN-KEYBOARD STUDY, PRIMARILY FOR TWO REASONS. FIRST, THE DIALOGUE IS NOT BROKEN DOWN OR DESCRIBED IN SUFFICIENT DETAIL TO ALLOW THE READER TO UNDERSTAND THE PARTICULAR DATA ENTRY AND COMMAND SELECTION TASKS INVOLVED. IT SEEMS CLEAR THAT DIFFERENT INPUT DEVICES ARE PREFERABLE FOR VARIOUS TASKS. FOR EXAMPLE, A TYPING TASK IS ALMOST CERTAINLY EASIER WITH AN ORDINARY KEYBOARD THAN WITH LIGHTPEN SELECTION OF A DISPLAYED KEYBOARD, WHILE LIGHTPEN SELECTION OF WHOLE WORDS IN A COMMAND SELECTION TASK MAY BE PREFERABLE TO TYPING OF THE WORDS ON A KEYBOARD. IT IS NOT CLEAR WHAT KINDS OF INPUT TASKS WERE REQUIRED OF THE OPERATOR IN THIS STUDY. THIS CRITICISM OFTEN APPLIES TO STUDIES IN WHICH AN ATTEMPT IS MADE TO STUDY PERFORMANCE IN AN ACTUAL SYSTEM CONTEXT, RATHER THAN WITH AN ARTIFICIAL LABORATORY TASK. A MORE DETAILED TASK DESCRIPTION WOULD HELP, HOWEVER. EVEN BETTER WOULD BE A BREAKDOWN OF TIME AND ERRORS BY TASK TYPE. SECONDLY, AN UNFORTUNATE RANDON ASSIGNMENT OF SUBJECTS TO GROUPS OCCURRED IN THIS STUDY. LEARNING RATE WAS FOUND TO CORRELATE SIGNIFICANTLY WITH PERFORMANCE ON A VOCABULARY TEST (R=-.73), INDICATING THAT INDIVIDUAL DIFFERENCES IN VOCABULARY PERFORMANCE ARE RELEVANT TO THE TASK. BUT IN 10 OUT OF 10 INSTANCES, THE SUBJECT ASSIGNED TO THE LIGHTPEN GROUP WAS POORER, BY THIS MEASURE, THAN THE CORRESPONDING KEYBOARD SUBJECT. THE BASIC METHODOLOGY OF THIS STUDY IS REASONABLE, AND THE DELAYED, INTERACTIVE RETENTION TEST IS A PARTICULARLY GOOD FEATURE. IT MAY, THEREFORE, BE OF INTEREST FOR ITS METHOD, BUT THE RESULTS ARE UNCLEAR.

# 351 INTERACTIVE GRAPHICS

MORRIS, I.L. HUMAN FACTORS FOR INTERACTIVE SYSTEMS. IN R.D. MURRAY (ED.), COMPUTER HANDLING OF GRAPHICAL INFORMATION. WASHINGTON, D.C.: SOCIETY OF PHOTOGRAPHIC SCIENTISTS AND ENGINEERS, 1970, 87-91.
DESCRIPTION:

THIS PAPER DESCRIBES THE "GRAPHICS AND TEXT EDITING SYSTEM" (GATES) FOR INTERACTIVE GRAPHICS AND TEXT MANIPULATION. IT IS SUGGESTED THAT COMPUTER GRAPHICS COULD REDUCE THE TIME REQUIRED FOR THE DESIGN PROCESS AND REDUCE "INTERFERENCE" PROBLEMS WHEN MANY DESIGNERS ARE WORKING ON A COMPLICATED PROJECT.

# SP, QR.

THIS IS A VERY BRIEF, FAIRLY HIGH LEVEL DISCUSSION OF THE ADVANTAGES OF INTERACTIVE GRAPHICS SYSTEMS IN EMGINEERING DESIGN. THIS PAPER WAS ORIGINALLY PRESENTED TO INTRODUCE A MOVIE THAT DESCRIBED ONE SUCH SYSTEM INCORPORATING A LIGHTPEN, PROGRAMMABLE FUNCTION KEYS, VARIABLE CONTROL DIALS, A DATA TABLET, AN ALPHANUMERIC KEYBOARD, A TELETYPE, A PRINTER/PLOTTER, AND A CRT. A KEY CONCEPT IS THAT THE USER SHOULD APPLY HEURISTICS IN ORDER TO SOLVE PROBLEMS AND RELY ON THE COMPUTER TO EXECUTE THE APPROPRIATE ALGORITHMS. THE ADVANTAGE OF USING INTERACTIVE GRAPHICS AS A COMMON POINT OF REFERENCE WHEN MULTIPLE DESIGNERS ARE INVOLVED ON A PROJECT ARE ALSO BRIEFLY CONSIDERED.

## 352 DISPLAYS

MUCKLER, F.A., & OBERMAYER, R.W. INFORMATION DISPLAY. INTERNATIONAL SCIENCE AND TECHNOLOGY, AUGUST 1965, 34-40.
DESCRIPTION:

DISPLAYS ARE INTENDED TO PROVIDE A HUMAN OPERATOR WITH THE KIND OF INFORMATION THAT HE CAN TRANSFORM INTO USEFUL DECISIONS OR CONTROL ACTIONS. WHILE THE TECHNOLOGY EXISTS TO PRESENT QUALITATIVE, QUANTITATIVE, SYMBOLIC, AND PICTORIAL DATA, IT IS NOT ALWAYS CERTAIN HOW THESE FORMS ARE BEST USED TO ASSURE THAT THE HUMAN RECEIVER IS GETTING CLEAR, UNABIGUOUS INFORMATION THAT CAN LEAD TO THE DESIRED DUTPUT OF THE TOTAL MAN-MACHINE SYSTEM. MAN IS A UNIQUE INFORMATION PROCESSOR BECAUSE HE GIVES MEANING TO INFORMATION. BUT HIS PROCESSING ABILITY IS LIMITED BY DATA LOAD AND SPEED STRESSES TO WHICH HE ADAPTS REMARKABLY IN WAYS THAT ARE NOT FULLY UNDERSTOOD. THE CONTEXT IN WHICH INFORMATION HAS VALUE IS IN A MACHINE ONLY TO THE DEGREE THAT SOME HUMAN'S HEAD. THIS CONTEXT IS IN A MACHINE ONLY TO THE DEGREE THAT SOME HUMAN HAS PUT IT THERE AS PRIOR CONTEXTUAL RULES OF HOW A SYSTEM SHOULD OPERATE. COMBINING SEVERAL TYPES OF DATA ON ONE DISPLAY INDICATOR DOES NOT ASSURE THE INTEGRATION OF INFORMATION, WHICH REALLY OCCURS IN THE CONTEXT OF MAN'S INTERPRETATION OF THE DISPLAY. MOST DESIGN HAS SUFFERED FROM A PRE-OCCUPATION WITH HARDWARE, RATHER THAN DEVELOPING BETTER COMMUNICATION WITH MAN. (0) 7P, OR.

#### COMMENTS:

THIS IS A GOOD GENERAL DISCUSSION OF SOME OF THE HUMAN FACTORS ASPECTS OF DISPLAYS. THE EMPHASIS IS ON HUMAN ABILITIES AND OPERATOR INFORMATION NEEDS AS THEY AFFECT THE CHOICE OF A PARTICULAR TYPE OF DISPLAY. THE DISCUSSION INCLUDES, BUT IS NOT RESTRICTED TO, COMPUTER DISPLAYS. THE PAPER IS A GOOD SOURCE OF INTRODUCTORY INFORMATION ON THIS TOPIC, BUT IS NOT INTENDED TO PROVIDE SPECIFIC GUIDELINES.

353 ALPHANUMERIC VS. GRAPHICAL DISPLAYS
NAWROCKI, L.H. ALPHA-NUMERIC VERSUS GRAPHIC DISPLAYS IN A PROBLEM-SOLVING TASK
(TECHNICAL RESEARCH NOTE 227). ARLINGTON, VIRGINIA: U.S. ARMY BEHAVIOR AND
SYSTEMS RESEARCH LABORATORY, SEPTEMBER 1972. (NTIS NO. AD 748799)
DESCRIPTION:

TO ASSIST COMMANDERS IN MAKING TACTICAL DECISIONS CONSISTENT WITH RAPID CHANGE AND SUCCESSION OF EVENTS, INFORMATION ON MILITARY OPERATIONS MUST BE PROCESSED AND DISPLAYED IN THE MOST EFFICIENT MANNER POSSIBLE. TO MEET THIS NEED, THE ARMY IS DEVELOPING AUTOMATED SYSTEMS FOR RECEIPT, PROCESSING, STORAGE, RETRIEVAL, AND DISPLAY OF DIFFERENT TYPES AND VAST AMOUNTS OF MILITARY DATA. AT THE SAME TIME, A REQUIREMENT EXISTS FOR RESEARCH TO DETERMINE HOW HUMAN ABILITIES CAN BE UTILIZED TO ACHIEVE THE OPTIMAL FUNCTIONAL EFFECTIVENESS OF INFORMATION PROCESSING SYSTEMS. BESRL'S MANNED SYSTEMS RESEARCH EFFORT IN THIS AREA IS CONCERNED WITH ENHANCEMENT OF HUMAN PERFORMANCE AND FACILITATION OF MAN-MACHINE INTERACTION IN RELATION TO TOTAL SYSTEM EFFECTIVENESS. EXPERIMENTATION FINDINGS HAVE IMPLICATIONS FOR SYSTEMS DESIGN, DEVELOPMENT, AND OPERATIONAL USE.

THE EXPERIMENT REPORTED ON HERE WAS DESIGNED TO DETERMINE HOW ALPHA-NUMERIC AND GRAPHIC PRESENTATION AFFECT PERFORMANCE, IN TERMS OF SPEED AND ACCURACY, UNDER TWO SETS OF STSTEM REQUIREMENTS: (1) BEED TO BASE A DECISION ON MEMORY OF INFORMATION PREVIOUSLY DISPLAYED VERSUS NO MEMORY REQUIREMENT, AND (2) COMPLEXITY OF INFORMATION TO BE HELD IN MEMORY (MEMORY LOAD).

RESULTS OF THIS STUDY, IN CONJUNCTION WITH PREVIOUS COMPARATIVE EVALUATION OF THE TWO ALTERNATIVE DISPLAY MODES, SUGGEST THAT UNDER A VARIETY OF TASKS AND CONDITIONS, THERE IS NO CLEAR-CUT ADVANTAGE TO THE USE OF EITHER ALPHA-MUMERIC OR GRAPHIC DISPLAYS WHEN MEMORY OF DISPLAYED MATERIAL WAS REQUIRED. HENCE, THE CHOICE OF DISPLAY TYPE MAY BE PRIMARILY ONE OF COST CONSIDERATION IF TIME AND ACCURACY ARE THE PRIMARY DETERMINANTS OF SYSTEM PERFORMANCE. HOWEVER, WHEN MEMORY WAS NOT REQUIRED, ALPHA-NUMERIC DISPLAYS RESULTED IN FEWER ERRORS OF OMISSION THAN DID GRAPHIC DISPLAYS. IT WAS ALSO FOUND THAT INCREASING COMPLEXITY CAUSED A DETERIORATION IN SPEED WHEN NO MEMORY WAS REQUIRED AND A DECREMENT IN ACCURACY WHEN MEMORY WAS REQUIRED. IN FURTHER RESEARCH, THE RELATIONSHIP BETWEEN TYPE OF ERRORS PRODUCED AND DISPLAY MODE WILL BE EXAMINED MORE CLOSELY, ESPECIALLY IN TASKS WHERE SPECIAL MANIPULATION OF ITEMS OF INFORMATION IS INVOLVED. (A) 30P, 6R.

COMMENTS:

THE EXPERIMENT DESCRIBED IN THIS PAPER IS STRAIGHTFORWARD AND APPEARS TO HAVE BEEN CAREFULLY CONDUCTED. THE CONCLUSION THAT THERE IS NO CLEAR-CUT ADVANTAGE TO THE USE OF EITHER ALPHA-NUMERIC OR GRAPHICAL DISPLAYS UNDER A VARIETY OF TASKS AND CONDITIONS IS, PERHAPS, MISLEADING. AS THE AUTHOR NOTES IN A BRIEF LITERATURE REVIEW, THE ADVANTAGES OR DISADVANTAGES OF EITHER TYPE OF DISPLAY APPEAR TO BE RELATED TO TASK REQUIREMENTS. THIS SUGGESTS THE NEED TO DEVELOP A CLEAR UNDERSTANDING OF A TASK ENVIRONMENT IN ORDER TO SELECT AN APPROPRIATE DISPLAY.

ERROR ANALYSIS

NAWROCKI, L.H., STRUB, M.H., & CECIL, R.M. ERROR CATEGORIZATION AND ANALYSIS IN MAN-COMPUTER COMMUNICATION SYSTEMS. IEEE TRANSACTIONS ON RELIABILITY, 1973, R-22, 135-140. DESCRIPTION:

THIS PAPER BRIEFLY EXAMINES TRADITIONAL APPROACHES TO HUMAN RELIABILITY AND PRESENTS A TECHNIQUE WHICH PERMITS THE SYSTEM DESIGNER TO DERIVE A MUTUALLY EXCLUSIVE AND EXHAUSTIVE SET OF OPERATOR ERROR CATEGORIES IN A MAN-COMPUTER SYSTEM. THESE ERROR CATEGORIES ARE DEFINED IN TERMS OF PROCESS FAILURES AND PROVIDE THE SYSTEM DESIGNER WITH A QUALITATIVE INDEX SUITABLE FOR DETERMINING ERROR CAUSES AND CONSEQUENCES. THE TECHNIQUE IS DEMONSTRATED, AND THE UTILITY OF THE RESULTING ERROR CATEGORIES IS EVALUATED IN THE COMTEXT OF TWO STUDIES ON A MILITARY INFORMATION PROCESSING THE PAPER CONCLUDES WITH A BRIEF DISCUSSION OF DETECTABLE AND NON-DETECTABLE ERRORS AND A SUGGESTION FOR DETERMINING THE IMPACT OF ERRORS ON ULTIMATE SYSTEM GOALS. (A)

THIS PAPER SUMMARIZES EXPERIMENTS ORIGINALLY PRESENTED BY STRUB (1971, 1972).

6P, 16R.

COMMENTS:

THIS PAPER DESCRIBES A SIMPLE, THOUGH APPARENTLY EFFECTIVE, TECHNIQUE FOR ERROR CLASSIFICATION. SUCH A CLASSIFICATION IS USEFUL IN IDENTIFYING AREAS IN WHICH COMPUTER AIDS COULD BE IMPLEMENTED TO DETECT ERRORS AND AREAS IN IN WHICH COMPUTER AIDS COULD BE IMPLEMENTED TO DETECT ERRORS AND AKEAS IN WHICH ERRORS COULD BE DETECTED AND CORRECTED ONLY BY THE HUMAN OPERATOR. AN INTERESTING CONCLUSION IS THAT BOX OF ALL ERRORS, IN THE TACTICAL INFORMATION HANDLING TASK STUDIED, COULD NOT BE DETECTED BY COMPUTER AIDS. THIS SUGGESTS THAT, AT LEAST INITIALLY, EFFORT SHOULD BE DIRECTED TOWARD IMPROVING TRAINING METHODS RATHER THAN ADDITIONAL SYSTEM FEATURES. WHETHER PROPOSED TECHNIQUE DOES, HOWEVER, PROVIDE A CONVENIENT WAY TO DETERMINE HOW RESOURCES SHOULD BE ALLOCATED TO REDUCE ERRORS.

DATA ENTRY

NEAL, A.S. TIME INTERVALS BETWEEN KEYSTROKES, RECORDS, AND FIELDS IN DATA ENTRY WITH SKILLED OPERATORS. HUMAN FACTORS, 1977, 19, 163-170 (ALSO: TECHNICAL REPORT HFC-B. SAN JOSE, CALIFORNIA: IBM CORP., SYSTEM DEVELOPMENT DIVISION, HUMAN FACTORS CENTER, OCTOBER 1974.) DESCRIPTION:

DESIGNERS OF SYSTEMS WHICH PROVIDE FOR DATA ENTRY FROM A KEYBOARD ARE USUALLY CONCERNED ABOUT THE RATE AND MANNER THAT KEYED DATA WILL ENTER THE THIS REPORT PROVIDES GENERALIZED KEYING RATE INFORMATION IN TERMS OF THE TIME BETWEEN KEYSTROKES, THE TIME BETWEEN RECORDS AND FIELDS, AND THE BURST RATES FOR MULTIPLE KEYSTROKES. THE TIME INTERVAL DATA IS PRESENTED IN THE FORM OF CUMULATIVE RELATIVE FREQUENCY DISTRIBUTION CURVES AND TABLES SHOWING THE MINIMINUM TIME INTERVAL AND SELECTED PERCENTILE POINTS. THE ANALYSES ARE BASED ON MORE THAN ONE MILLION KEYSTROKES OF DATA THAT WERE COLLECTED WITH FIFTEEN KEYPUNCH OPERATORS ON AN IBM 3741 DATA ENTRY SYSTEM IN A TYPICAL DATA ENTRY APPLICATION.

COMMENTS:

THE TYPES OF DATA MENTIONED IN THE ABSTRACT ARE CLEARLY PRESENTED IN THIS PAPER. THERE IS NO ATTEMPT, HOWEVER, TO ANALYZE, SUMMARIZE, OR DISCUSS THE IMPLICATIONS OF THESE RESULTS. THERE APPEARS TO BE VERY LITTLE VARIANCE IN THE REPORTED DATA AND THIS SUGGESTS THAT THE VALUES PRESENTED COULD BE USED AS NORMATIVE VALUES, AT LEAST FOR THE TYPE OF TASK AND SUBJECTS USED IN THIS STUDY. THERE ARE NO DISCUSSIONS OF THE HUMAN FACTORS ASPECTS OF KEYBOARD DATA ENTRY.

356 PERSONALIZED SYSTEMS, WITH HAND-SKETCH RECOGNITION EXAMPLE
NEGROPONTE, N. IDIOSYNCRATIC SYSTEMS: TOWARD PERSONAL COMPUTERS AND
UNDERSTANDING CONTEXT. CAMBRIDGE, MASSACHUSETTS: MASSACHUSETTS INSTITUTE OF
TECHNOLOGY, ARCHITECTURE MACHINE GROUP, JUNE 1975.
DESCRIPTION:

AN IDIOSYNCRATIC SYSTEM IS A PERSONALIZED COMPUTER, INTIMATELY ACQUAINTED WITH A SPECIFIC USER. FAMILIARITY IS GAINED OVER TIME, THROUGH SHARED EXPERIENCES, AND IN CONTEXT-DEPENDENT, INTERPERSONAL HYPOTHESES. PERSONALIZATION OFFERS THE POSSIBILITY OF MACHINE RECOGNITION AND UNDERSTANDING OF CONVERSATIONS THAT OTHERWISE APPEAR AMBIGUOUS, INCOMPLETE, OR VAGUE. THE PAPER POSTULATES POWERFUL, DEDICATED, AND UBIQUITOUS MACHINES. WE PRESENT A MODEST EXAMPLE OF HOW KNOWING THE USER CAN HELP THE COMPUTER TO RECOGNIZE HIS HAND-DRAWN SKETCHES. WE SUGGEST SOME FUTURE DEVELOPMENTS IN CONSUMER-ORIENTED APPLICATIONS IN EDUCATION AND ENTERTAINMENT. THE PAPER PRESENTS NOT THE CONTOURS OF A WELL FORMED THEORY, BUT SPOTS OF POTENTIALITY, APPLICATION, OPTIMISM, AND CAUTION. (A)

COMMENTS:

THE TYPE OF SYSTEM PROPOSED IN THIS PAPER WOULD BE A VERY SIGNIFICANT DEVELOPMENT IN THE FIELD OF MAN-COMPUTER INTERACTION. SUCH A SYSTEM COULD MAKE INFERENCES ABOUT WHAT THE USER INTENDS, OFFER TIMELY SUGGESTIONS, CRITIQUE THE USER'S DECISIONS, ETC. ALTHOUGH DESIRABLE, SUCH A SYSTEM IS NOT IMMEDIATELY ATTAINABLE. THE AUTHOR DOES A GOOD JOB OF IDENTIFYING THOSE AREAS OF COGNITIVE PSYCHOLOGY AND ARTIFICIAL INTELLIGENCE THAT ARE RELEVANT TO DEVELOPING AN IDIOSYNCRATIC SYSTEM. THE TRANSFORMATION OF SUCH THEDRIES INTO SPECIFIC GUIDELINES FOR SYSTEM DEVELOPMENT WILL REQUIRE A GREAT DEAL OF RESEARCH. THE MORE LIMITED EXAMPLE DEVELOPED IN THIS PAPER INVOLVES THE RECOGNITION OF HAND SKETCHES. THIS EXAMPLE IS CONVINCINGLY DEVELOPED AS A CURRENTLY FEASIBLE INSTANCE OF THE TYPE OF PERSONALIZATION TOWARD WHICH THE AUTHOR WOULD HAVE US STRIVE.

357 MAN-COMPUTER DIALOGUE ASPECTS OF NETWORK PROTOCOLS
NEUMANN, A.J. A BASIS FOR STANDARDIZATION OF USER-TERMINAL PROTOCOLS FOR
COMPUTER NETWORK ACCESS (REPORT NO. NBS-TN-877). WASHINGTON, D.C.: NATIONAL
BUREAU OF STANDARDS, JULY 1975. (NTIS NO. COM-75-11124)
DESCRIPTION:

A USER-TERMINAL PROTOCOL IS DEFINED WHICH ENABLES A USER AT A TERMINAL TO ACCESS COMPUTERIZED INFORMATION SYSTEMS. THE BASIC FUNCTIONS SUCH AS IDENTIFICATION, AUTHORIZATION, AND VALIDATION ARE OUTLINED AND VARIOUS SIGNALS AND MESSAGES MAKING UP THE PROTOCOL ARE IDENTIFIED. THE PURPOSE OF THE PAPER IS TO ESTABLISH A BASIS FOR STANDARDIZATION AND DEVELOPMENT OF A UNIFIED USER PROTOCOL. (A)

29P, SR.

THIS IS A PROPOSED STANDARD FOR MAN-COMPUTER DIALOGUES IN CONJUNCTION WITH INFORMATION RETRIEVAL SYSTEMS. THE STANDARD WAS REVIEWED AND APPROVED BY INFORMATION SERVICE AUTHORITIES AND SOFTWARE SUPPLIERS. HUMAN FACTORS ASPECTS OF MAN-COMPUTER DIALOGUES ARE NOT CONSIDERED, BUT MOST HUMAN FACTORS GUIDELINES COULD BE INCORPORATED WITHIN THE SPECIFIED STANDARD.

MAN-COMPUTER PROBLEM SOLVING

NEWELL, A. THE POSSIBILITY OF PLANNING LANGUAGES IN MAN-COMPUTER COMMUNICATION. IN F.A. GELDARD (ED.), COMMUNICATION PROCESSES. NEW YORK: MACMILLAN, 1965, 238-259.

DESCRIPTION:

COMMUNICATION BETWEEN MEN AND COMPUTERS IS BUT A SMALL PART OF THE STUDY OF COMMUNICATION PROCESSES OF MEN IN HIGHLY ORGANIZED AND TECHNOLOGICAL ENVIRONMENTS, AND THE TOPIC OF THIS PAPER IS BUT A SMALL PART OF THE WHOLE TOPIC OF MAN-COMPUTER COMMUNICATION. I WISH TO DISCUSS A CORNER OF THE FIELD THAT IS SOMEWHAT UNEXPLORED, AND WHICH I WILL PRESENTLY REFER TO AS PLANNING LANGUAGES, FOR LACK OF A BETTER NAME. ONE PURPOSE OF THE PAPER IS TO SHOW A WAY IN WHICH THE SIMULATION OF COGNITIVE PROCESSES AND THE DEVELOPMENT OF ARTIFACTS THAT EXHIBIT INTELLIGENCE CAN CONTRIBUTE TO THE AREA OF MAN-COMPUTER COMMUNICATION. I HOPE, ALSO, TO BROADEN THE NOTION OF WHAT COMMUNICATION PROCESSES ARE ALL ABOUT, PRIMARILY WITH RESPECT TO COMMUNICATION WITH A COMPUTER, BUT PERHAPS EVEN WITH RESPECT TO COMMUNICATION BETWEEN MEN. THIS MAY EVEN SUGGEST HOW STUDENTS OF HUMAN BEHAVIOR CAN CONTRIBUTE CENTRALLY TO THE PROBLEMS OF MAN-COMPUTER COMMUNICATION. 22P, 9R.

COMMENTS:

THIS IS A VERY INTERESTING PAPER THAT PRESENTS A NEW ASPECT OF MAN-COMPUTER COMMUNICATION. IN PROBLEM SOLVING, MAN INITIALLY DEVELOPS A RATHER ILL-DEFINED CONCEPT OF HOW TO ACHIEVE A SOLUTION AND THEN PROCEEDS TO DEVELOP A MORE DETAILED SOLUTION PLAN. IN MOST INTERACTIVE SYSTEMS, THE MAN-COMPUTER COMMUNICATION TAKES PLACE AT THE LEVEL OF THIS DETAILED SOLUTION PLAN. THIS PAPER EXPLORES THE POSSIBILITY OF EFFECTIVE COMMUNICATION AT THE LEVEL OF LESS DETAILED PLANS. THIS PAPER ALSO ILLUSTRATES THE IMPORTANCE OF RESEARCH IN COGNITIVE PSYCHOLOGY AND ARTIFICIAL INTELLIGENCE TO THE STUDY OF MAN-COMPUTER COMMUNICATION.

### COMMAND LANGUAGES

NEWMAN, J.C. THE PROCESSING OF TWO TYPES OF COMMAND STATEMENT: A CONTRIBUTION TO COGNITIVE ERGONOMICS. PAPER PRESENTED AT NATO ADVANCED STUDY INSTITUTE ON RAN-COMPUTER INTERACTION, MATI, GREECE, SEPTEMBER 1976 (ALSO: IEFE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS, IN PRESS). DESCRIPTION:

THE LACK OF A COGNITIVE PSYCHOLOGY OF COMMAND STATEMENTS IS IDENTIFIED AS A MAJOR RESTRICTION ON HUMAN FACTORS STUDIES IN COMPUTING. HUMAN COMMAND PROCESSING WAS INVESTIGATED IN AN EXPERIMENT IN WHICH TEN SUBJECTS READ AND EXECUTED IMPERATIVE STATEMENTS OF TWO LOGICAL TYPES, DESIGNATED HYPOTHETICAL STANDING COMMANDS AND HYPOTHETICAL ONE-SHOT COMMANDS RESPECTIVELY. ANALYSIS OF ENCODING TIME, EXECUTION ERRORS AND EXECUTION REACTION TIMES SHOWED THAT THE PROCESSING OF ONE-SHOT COMMANDS IS MORE COMPLEX THAN THAT OF STANDING COMMANDS. FREE RECALL OF COMMAND SETS REVEALED ORGANIZATION PROCESSES ANALOGOUS TO THOSE INVOLVED IN "POSITIVE FORGETTING." APPLICATION OF THE RESULTS TO THE COGNITIVE ENGINEERING OF HUMAN-TO-SOFTWARE INTERFACES IS DISCUSSED, AND DIRECTIONS FOR FURTHER INVESTIGATION ARE BRIEFLY OUTLINED. (A)

33R.

COMMENTS:

THIS IS AN INTERESTING EXPERIMENT. THE RATIONALE AND PROCEDURES ARE CLEARLY DESCRIBED AND, WITH THE EXCEPTION OF THE FAILURE TO REPORT SOME POTENTIALLY RELEVANT STATISTICAL TESTS, THE ANALYSIS IS CLEARLY PRESENTED. THE AUTHOR IS CORRECT IN NOTING THAT COMMANDS AND INSTRUCTIONS ARE AN INTEGRAL PART OF MAN-COMPUTER COMMUNICATION. IN GENERAL, HOWEVER, THE USER ISSUES RATHER THAN EXECUTES COMMANDS. SINCE THIS STUDY IS CONCERNED ONLY WITH COMMAND EXECUTION, ITS DIRECT, PRACTICAL APPLICABILITY APPEARS LIMITED. THE ISSI AND CONCEPTS RAISED ARE QUITE GOOD, HOWEVER, AND COULD BE VERY USEFUL IN CONDUCTING RESEARCH ON COMMAND GENERATION. THE ISSUES

360 METHODOLOGICAL ISSUES IN HUMAN FACTORS IN COMPUTER SYSTEMS
NEWMAN, J.C. USER PSYCHOLOGY: THE EXPERIMENTAL STRATEGY. NEWTOWNABBEY,
NORTHERN IRELAND: ULSTER COLLEGE, THE NORTHERN IRELAND POLYTECHNIC, 1977.
DESCRIPTION:

THE HUMAN SCIENCES HAVE TO DATE MADE ONLY A LIMITED CONTRIBUTION TO THE DESIGN AND DEVELOPMENT OF INFORMATION SYSTEMS; ATTENTION HAS BEEN CHIEFLY DIRECTED TO THE EVALUATION OF PRE-EXISTING ALTERNATIVES, THUS GAINING IMMEDIATE RELEVANCE AT THE EXPENSE OF UNIVERSALISABILITY. A FRAMEWORK IS PRESENTED FOR DECISION-MAKERS TO CLARIFY AND ASSESS THE AVAILABLE OPTIONS FOR ALLOCATION OF RESOURCES TO RESEARCH ON HUMAN FACTORS IN COMPUTING, AND WITHIN THIS FRAMEWORK PARTICULAR ATTENTION IS FOCUSED ON THE POTENTIAL OF THE EXPERIMENTAL METHOD. (A) 12P, 15R.

COMMENTS:

THIS IS A FAIRLY GENERAL DISCUSSION OF THE RELATIVE ADVANTAGES AND DISADVANTAGES OF FIELD STUDIES AND CONTROLLED EXPERIMENTS, AND OF THE GENERALITY AND INTERPRETATION OF EXPERIMENTAL RESULTS. RESEARCH ON HUMAN FACTORS IN COMPUTER SYSTEMS, OR OTHER "REAL WORLD" TASKS, CAN BE VERY DIFFICULT TO CONDUCT. FOR EXAMPLE, A TASK CONSTRUCTED FOR LABORATORY USE MAY NOT ACCURATELY MODEL THE ACTUAL TASK OF INTEREST OR PROPER EXPERIMENTAL CONTROL CANNOT BE ATTAINED IN FIELD STUDIES. ALTHOUGH DIFFICULT, CONTROLLED RESEARCH IS NOT IMPOSSIBLE. THE AUTHOR MAKES SEVERAL REASONABLE SUGGESTIONS AS TO THE ROLE OF PSYCHOLOGISTS IN SYSTEM DESIGN, ALL OF WHICH REQUIRE VERY CLOSE INTERACTION WITH THE SYSTEM DESIGNERS AND CONTROLLED RESEARCH. ALTHOUGH THIS PAPER BONTAINS SOME VERY INTERESTING AND WORTHWHILE IDEAS, EXPRESSED AT A VIEW OF MERAL LEVEL, SYSTEM DESIGNERS MAY OPPOSE THEIR IMPLEMENTATION OF THE BASIS THAT PSYCHOLOGISTS KNOW LITTLE ABOUT SYSTEM DESIGN. THE PRINCIPLAR POINT, HOWEVER, IS THAT PSYCHOLOGISTS AND SYSTEM DESIGNERS MAY ACTUALLY HAVE VERY COMPLEMENTARY CAPABILITIES.

361 MAN-COMPUTER PROBLEM SOLVING

NEWMAN, J.R. EXTENSION OF HUMAN CAPABILITY THROUGH INFORMATION PROCESSING AND DISPLAY SYSTEMS (TECHNICAL REPORT SP-2560/000/00). SANTA MONICA, CALIFORNIA: SYSTEM DEVELOPMENT CORP., DECEMBER 1966 (PAPER PRESENTED AT MEETING OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION, NEW YORK, SEPTEMBER 1966). (NTIS NO. AD 645435)

DESCRIPTION:

THIS PAPER DISCUSSES SOME OF THE BASIC PRINCIPLES AND TECHNIQUES OF MAN-MACHINE INTERACTION AND GIVES SEVERAL ILLUSTRATIONS OF INSTANCES IN WHICH HUMAN CAPABILITY HAS BEEN ENHANCED BY COMPUTER AND DISPLAY SYSTEMS. IT ALSO DISCUSSES THE IMPLICATIONS OF THESE PRINCIPLES FOR THE BUSINESS AND INDUSTRIAL COMMUNITY. (A) 11P, 6R.

COMMENTS:

THIS PAPER PROVIDES A BRIEF, HISTORICAL DESCRIPTION OF SOME OF THE CONCEPTS, VIEWPOINTS, AND ACHIEVEMENTS IN THE AREA OF MAN-COMPUTER PROBLEM SOLVING. THIS PAPER WOULD BE USEFUL AS AN INTRODUCTION TO THE THEN-CURRENT STATE OF THE ART IN THIS AREA, BUT WOULD NOT BE RELEVANT TO THOSE WISHING TECHNICAL DISCUSSIOMS OF MAN-COMPUTER PROBLEM-SOLVING SYSTEMS.

362 MAN-COMPUTER PROBLEM SOLVING

NEWMAN, J.R., & ROGERS, M.S. EXPERIMENTS IN COMPUTER-AIDED INDUCTIVE REASONING (TECHNICAL REPORT TM-3227). SANTA MONICA, CALIFORNIA: SYSTEM DEVELOPMENT CORP., DECEMBER 1966. (NTIS NO. AD 645422) DESCRIPTION:

THIS DOCUMENT REPORTS ON A PROGRAM OF RESEARCH ON HUMAN PROBLEM-SOLVING BEHAVIOR WHEN THAT BEHAVIOR IS BEING ASSISTED BY CERTAIN COMPUTER AND DISPLAY AIDS. THE RESEARCH IS PARTICULARLY CONCERNED WITH PROBLEM SOLVING THAT INVOLVES INDUCTIVE REASONING OR CONCEPT FORMATION. PREVIOUS INVESTIGATIONS HAVE INDICATED THAT HUMAN SUBJECTS USE A VARIETY OF SYSTEMATIC OPERATIONS WHEN THEY ARE SOLVING SUCH PROBLEMS ONE PURPOSE OF THIS PROJECT IS TO CARRY OUT AN EXPERIMENTAL ANALYSIS OF SOME OF THESE OPERATIONS AND THEIR EXPLICIT USES. TO ACCOMPLISH THIS PURPOSE, THE OPERATIONS ARE MADE AVAILABLE TO THE PROBLEM SOLVER IN THE FORM OF COMPRIER AND DISPLAY AIDS SO THAT HE CAN CALL FOR THEIR IMPLEMENTATION QUITE EASILY. THE PROBLEM SOLVER IS THUS RELIEVED OF THE BURDEN OF ACTUALLY CARRYING OUT THE DETAILS OF THE OPERATIONS. FURTHERMORE, THROUGH THE COMPLETE RECORDING OF THE USE OF THESE COMPUTER AIDS, SOME ASPECTS OF THE PROBLEM-SOLVING PROCESS ARE EXTERNALIZED FOR EXAMINATION BY THE RESEARCHER. (A)

NALIZED FOR EXAMINATION BY THE RESEARCHER. (A)

THERE WAS AN OVERALL FACILITATION DUE TO THESE AIDS AND THE USEFULNESS OF THESE AIDS WAS DIRECTLY RELATED TO PROBLEM DIFFICULTY.
78P, 38R.

COMMENTS:

IN A VARIETY OF PROBLEM SOLVING TASKS, HUMAN PROBLEM SOLVERS USE A VARIETY OF PROCESSES TO EVALUATE ALTERNATIVE ACTIONS THAT COULD BE TAKEN. HUMAN PROCESSING LIMITATIONS, HOWEVER, MAY PREVENT THESE PROCESSES FROM BEING EXECUTED EFFICIENTLY. THE SYSTEM DESCRIBED IN THIS PAPER AUTOMATES SOME OF THESE PROCESSES SO THAT A PROBLEM SOLVER CAN REQUEST THEIR EXECUTION RATHER THAN CARRYING OUT THESE PROCESSES HIMSELF. THE EXPERIMENT REPORTED IN THIS PAPER APPEARS TO HAVE BEEN CAREFULLY CONDUCTED AND INDICATES THAT THE PROBLEM-SOLVING AIDS UTILIZED WERE USEFUL AND THEIR VALUE INCREASED AS PROBLEM DIFFICULTY INCREASED. THIS IS AN INTERESTING EXAMPLE OF AN AID FOR MAN-COMPUTER PROBLEM SOLVING.

363 RESPONSE TIME IN INTERACTIVE GRAPHICS
NEWMAN, W.M. INTERACTIVE GRAPHICAL RESPONSE AND ITS EFFECTS ON DISPLAY SYSTEM
PERFORMANCE. IN PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON MAN-MACHINE
SYSTEMS, 8-12 SEPTEMBER 1969 (VOL. 4) (IEEE CONFERENCE RECORD NO. 69C58-MMS).
NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., 1969.
DESCRIPTION:

THE HIGH COST OF COMPUTER DISPLAY EQUIPMENT HAS GENERALLY PREVENTED ITS USE IN AREAS WHERE IT COULD BE OF GREAT VALUE, FOR EXAMPLE IN COMPUTER-AIDED DESIGN. DISPLAY TERMINALS HAVE RECENTLY BEEN INTRODUCED WHICH PROVIDE A SOMEWHAT REDUCED INTERACTIVE RESPONSE AT A GREATLY REDUCED COST PER TERMINAL. HOWEVER, IT IS NOT CLEAR HOW MUCH THE REDUCED PERFORMANCE OF LOW-COST DISPLAYS LIMITS THEIR RANGE OF APPLICATION, NOR AT WHAT POINT THE NEED FOR A MORE POWERFUL DISPLAY SYSTEM WILL OUTWEIGH ITS ADDITIONAL COST.

THIS PAPER IS DEVOTED TO A DISCUSSION OF HOW EFFECTIVE USE CAN BE MADE OF DIFFERENT TYPES OF DISPLAY EQUIPMENT. THIS DISCUSSION IS BASED ON PAST EXPERIENCE OF DISPLAY USERS, AND ALSO ON A SERIES OF EXPERIMENTS TO SIMULATE THE USE OF VARIOUS TYPES OF DISPLAY FOR DIFFERENT CLASSES OF GRAPHICAL OPERATION. THE PAPER CONCLUDES WITH SOME SUGGESTED AREAS OF APPLICATION FOR THE VARIOUS TYPES OF DISPLAY CONSIDERED. (A) 10P, 9R.

COMMENTS:

THIS PAPER IS PRIMARILY CONCERNED WITH SYSTEM RESPONSE TIME AND THE EFFECTS OF RESPONSE TIME ON USE REACTION TIME. AN EXPERIMENT IS REPORTED BRIEFLY. R.B. MILLER (1968) SUGGESTED THAT THE COST OF INCREASING DELAYS MAY BE A STEP FUNCTION, RATHER THAN CONTINUOUS. THUS, A RESPONSE TIME THAT IS ONLY CLOSE TO OPTIONAL MAY BE AS UNACCEPTABLE AS ONE THAT IS FARTHER FROM OPTIONAL. THE EXPERIMENT REPORTED IN THIS PAPER SUGGESTS THAT THE EFFECTS OF RESPONSE TIME MAY BE NON-MONOTONIC. THAT IS, THERE IS SOME OPTIMAL RESPONSE TIME AND RESPONSE TIMES EITHER FASTER OR SLOWER WILL RESULT IN DEGRADED PERFORMANCE. ALTHOUGH THIS APPEARS POSSIBLE, ESPECIALLY IN THE TYPE OF TASK USED IN THE EXPERIMENT, THIS PAPER DOES NOT PROVIDE SUFFICIENT DETAIL TO ALLOW AN EVALUATION OF THE VALIDITY OR IMPLICATIONS OF THIS ASSUMPTION.

364 MODELS OF MAN-COMPUTER INTERACTION

NEWMAN, W.M. LANGUAGES FOR DESCRIBING INTERACTION. IN W. HAENDLER & J. WEIZENBAUM (EDS.), DISPLAY USE FOR MAN-MACHINE DIALOG. NEW YORK: CRANE, RUSSAK & CO., INC., 1972, 19-32.

DESCRIPTION:

DESPITE THE CURRENT INTEREST IN INTERACTIVE COMPUTER SYSTEMS, ONE HEARS LITTLE SAID ABOUT PROGRAMMING TECHNIQUES OR LANGUAGES FOR DESCRIBING INTERACTION. IT IS FAIRLY CLEAR THAT THESE DAYS MOST INTERACTIVE PROGRAMS ARE WRITTEN IN CONVENTIONAL PROGRAMMING LANGUAGES TO WHICH MINOR EXTENSIONS HAVE BEEN MADE TO PERMIT INTERACTIVE USE. SPECIAL TECHNIQUES FOR DESCRIBING INTERACTION ARE IMPORTANT SINCE THEY DETERMINE HOW EASY IT IS TO USE A LANGUAGE FOR A SPECIFIC TASK, OR HOW EFFICIENTLY IT PERFORMS THE TASK. IN FACT, THESE ASPECTS OF A LANGUAGE PERMEATE BACK AND INFLUENCE THE WAY WE APPROACH THE DESIGN OF ALGORITHMS AND PROCESSES. THE DESIGN OF INTERACTIVE PROGRAMS IS VERY LIKELY TO BE AFFECTED IN FUNDAMENTAL WAYS BY THE MANNER IN WHICH INTERACTION IS DEFINED. (A, ABBR.)

COMMENTS:

THIS PAPER COMPARES TWO DIFFERENT TYPES OF MODELS OF INTERACTION. THE FIRST, SIMPLE DIALOG MODELS, ARE PRIMARILY CONCERNED WITH ADAPTATIONS OF BATCH PROCESSING LANGUAGES, AND THE SECOND, FINITE STATE MACHINE MODELS, ARE MORE USEFUL WITH MORE SPECIALIZED LANGUAGES. THERE IS NO DOUBT THAT THE LANGUAGE USED TO WRITE INTERACTIVE PROGRAMS HAS LARGE EFFECTS ON THE USE OF SUCH PROGRAMS. THE TYPES OF MODELS DISCUSSED IN THIS PAPER MAY BE USEFUL IN DESIGNING MORE EFFECTIVE LANGUAGES. AS THE AUTHOR NOTES, HOWEVER, MODELS HAVE BEEN DEVELOPED ONLY FOR A RATHER LIMITED CLASS OF INTERACTIVE SITUATIONS. GRAPHICAL INTERACTIONS, IN PARTICULAR, ARE APPARENTLY VERY DIFFICULT TO SUCCESSFULLY MODEL.

365 MAN-COMPUTER PROBLEM SOLVING

NEWSTED, P.R., & WYNNE, B.E. AUGMENTING MAN'S JUDGMENT WITH INTERACTIVE COMPUTER SYSTEMS. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1976, 8, 29-59. DESCRIPTION:

AN INTERACTIVE DECISION SYSTEM (AIDS) IS DESCRIBED AS A COMPUTER-BASED TECHNIQUE TO RATIONALIZE THE JUDGMENT PROCESS. THIS TECHNIQUE IS INTENDED TO ALLOW A TYPICAL MANAGER TO MAKE DECISIONS WITH MORE COMPLETE USE OF INFORMATION AVAILABLE AND FEWER LOOSE ENDS THAN IS USUALLY THE CASE. IT HAS BEEN DERIVED FROM THE INFORMATION PROCESSING ROUTINES USED BY KEPNER AND TREGUE (1965) IN THEIR DECISION TRAINING PROGRAMS.

TREGUE (1965) IN THEIR DECISION TRAINING PROGRAMS.

A COMPLETE SESSION WITH AIDS USING A DECISION ABOUT NEPOTISM IS INCLUDED AS AN EXAMPLE. PRELIMINARY TESTING OF AIDS IS DESCRIBED. (A) 31P, 11R.

COMMENTS:

THIS IS AN INTERESTING EXAMPLE OF A COMPUTERIZED DECISION AID WHICH PROVIDES EXTENDED MEMORY AND DATA REORGANIZATION CAPABILITY BUT "KNOWS" NOTHING ABOUT THE PROBLEM (I.E., IS CONTENT-FREE). EMBEDDED IN THE AID IS A FIXED PROCEDURE FOR ELICITING FROM THE USER DECISION-RELEVANT INFORMATION AND ORGANIZING IT IN A WAY WHICH MAY ASSIST HIM IN MAKING A DECISION. THE DECISION AID IS ONLY AS GOOD AS THIS FIXED PROCEDURE, WHICH MAY OR MAY NOT BE BROADLY APPLICABLE. ALTHOUGH THE AUTHORS REPORT FAIRLY GOOD RESULTS FROM USE OF THE SYSTEM BY NINE GRADUATE STUDENTS, THIS WAS NOT A CONTROLLED EXPERIMENT AT ALL. CONTROLLED EXPERIMENTATION IS NEEDED TO DETERMINE TO WHAT EXTENT SUCH A DECISION AID HELPS, AND TO WHAT CLASSES OF DECISION TASKS AND USERS IT IS APPLICABLE.

366 REVIEW OF USER INTERACTION WITH NAVY COMPUTER SYSTEMS
NICHOLSON, R.M., WIGGINS, B.D., & SILVER, C.A. AN INVESTIGATION INTO SOFTWARE
STRUCTURES FOR MAN/MACHINE INTERACTIONS. ARLINGTON, VIRGINIA: ANALYTICS, INC.,
FEBRUARY 1972. (NTIS NO. AD 737266)
DESCRIPTION:

THE CURRENT TREND IN COMMAND AND CONTROL/INFORMATION SYSTEMS WITHIN THE NAVY, TOWARD GREATER USE OF INTERACTIVE CAPABILITIES, HAS THE EFFECT OF BRINGING THE TRUE "USER" -- THE DECISION MAKER -- INTO DIRECT CONTACT WITH THE SYSTEM, RATHER THAN USING A PROGRAMMER AS AN INTERMEDIARY. IT IS THEREFORE NECESSARY THAT THE SYSTEM DESIGNER ORIENT THE MAN/MACHINE COMMUNICATION LESS TOWARD HIS OWN PROGRAMMING COMMUNITY AND MORE TOWARD A USER WHOSE FAMILIARITY WITH COMPUTER DEVICES AND TERMINOLOGY IS SOMEWHAT LESS THAN HIS OWN.

FOR A CLEAR VIEW OF THE TYPICAL USER AND THE FUNCTIONS HE AND THE SYSTEM

FOR A CLEAR VIEW OF THE TYPICAL USER AND THE FUNCTIONS HE AND THE SYSTEM PERFORM, A SURVEY OF RECENT NAVY SYSTEMS IS DESCRIBED. A REVIEW OF THE LITERATURE IN INFORMATION SYSTEMS TO DETERMINE THE AVAILABILITY OF INFORMATION USEFUL TO THE SYSTEM DESIGNER IN INTERACTIVE SOFTWARE PERFORMANCE IS PRESENTED. FINALLY, A RESEARCH PROGRAM TO DERIVE THE NEEDED INFORMATION IS PROPOSED. (A) 92P, 55R.

#### COMMENTS:

THIS PAPER CONTAINS A LITERATURE REVIEW ON MAN-COMPUTER INTERACTION IN INFORMATION SYSTEMS, AS WELL AS AN ANNOTATED BIBLIOGRAPHY. ALTHOUGH BRIEF, THIS REVIEW WOULD PROVIDE INTRODUCTORY MATERIAL TO ANYONE INTERESTED IN THIS AREA. THE MAIN BODY OF THIS PAPER IS INTENDED TO SUPPORT THE PROPOSED RESEARCH PROGRAM. THE AUTHORS PRESENT CLASSIFICATION SCHEMES FOR INTERFACE CLASSES, SOFTWARE STRUCTURES, AND CLASSES OF HUMAN FUNCTIONS. ALTHOUGH BASED ON A SUBJECTIVE CLASSIFICATION OF THEN-CURRENT NAVAL SYSTEMS, THESE TAXONOMIES MIGHT BE USEFUL IN A VARIETY OF INTERACTIVE SYSTEMS.

367 GENERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
NICKERSON, R.S. MAN-COMPUTER INTERACTION: A CHALLENGE FOR HUMAN FACTORS
RESEARCH. ERGONOMICS, 1969, 12, 501-517.
DESCRIPTION:

THIS PAPER CLAIMS THAT THE INCREASING HETEROGENEITY OF THE COMMUNITY OF COMPUTER USERS POSES A CHALLENGE TO PSYCHOLOGISTS AND HUMAN FACTORS RESEARCHERS. THERE FOLLOWS A BRIEF DISCUSSION OF WHY THIS CHALLENGE APPARENTLY HAS NOT YET EVOKED A STRONG RESPONSE. THREE PROBLEMS, OR PROBLEM AREAS, ARE IDENTIFIED AS BEING PARTICULARLY IN NEED OF HUMAN FACTORS RESEARCH. THESE ARE (1) THE DEVELOPMENT AND EVALUATION OF CONVERSATIONAL LANGUAGES, (2) THE DETERMINATION OF HOW THE USE PATTERNS ADOPTED BY USERS DEPEND ON SYSTEM CHARACTERISTICS, AND (3) THE DESCRIPTION, OR MODELLING, OF MAN-COMPUTER INTERACTION. (A)

THE PAPER INCLUDES A REVIEW OF THE LITERATURE IN THE THREE PROBLEM AREAS MENTIONED ABOVE.

17P, 50R.

# COMMENTS:

THIS IS A VERY GOOD PAPER THAT ARGUES FOR THE NEED FOR PSYCHOLOGISTS AND HUMAN FACTORS RESEARCHERS IN THE DEVELOPMENT OF INTERACTIVE SYSTEMS. THE AUTHOR PRESENTS A CLEAR AND INTERESTING DISCUSSION OF SOME FREQUENTLY MADE ARGUMENTS AGAINST INCLUDING SUCH PERSONNEL IN SYSTEM DEVELOPMENT AND THEN PROCFEDS TO DESCRIBE SOME OF THE HUMAN FACTORS WORK THAT HAS BEEN DONE IN THE DESIGN OF INTERACTIVE SYSTEMS. ALTHOUGH THE TECHNICAL DISCUSSIONS IN THIS PAPER ARE DATED, MANY OF THE ARGUMENTS AND IDEAS PRESENTED ARE STILL VIABLE.

368 GENERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
NICKERSON, R.S., ELKIND, J.I., & CARBONELL, J.R. HUMAN FACTORS AND THE DESIGN
OF TIME SHARING COMPUTER SYSTEMS. HUMAN FACTORS, 1968, 10, 127-133.
DESCRIPTION:

THE ADVENT OF COMPUTER TIME SHARING POSES AN EXTRAORDINARY CHALLENGE TO HUMAN FACTORS RESEARCH DURING THE NEXT DECADE. BEFORE TIME SHARING, TWO FACTS COMBINED TO DE-EMPHASIZE THE IMPORTANCE OF HUMAN FACTORS CONSIDERATIONS IN THE DESIGN OF COMPUTER SYSTEMS: (1) THE COST OF THE COMPUTER'S TIME WAS EXORBITANTLY HIGH RELATIVE TO THE COST OF USERS' TIME, AND (2) THE USERS CONSTITUTED A SELECT, HIGHLY SKILLED AND HIGHLY MOTIVATED GROUP OF SPECIALISTS. TWO OF THE PROMISES OF TIME SHARING, HOWEVER, ARE (1) A DRASTIC REDUCTION IN THE COST OF COMPUTER TIME TO THE INDIVIDUAL USER, AND (2) THE LARGE SCALE AVAILABILITY OF COMPUTER FACILITIES TO INDIVIDUALS UNTRAINED IN ANY AREAS OF COMPUTER TECHNOLOGY. HUMAN FACTORS CONSIDERATIONS THEN BECOME IMPORTANT BOTH FOR ECONOMIC AND PSYCHOLOGICAL REASONS. (A)

PRINCIPAL AREAS DISCUSSED ARE: "CONVERSATIONAL" LANGUAGES, SYSTEM RESPONSE TIME, CHARGING ALGORITHMS AND THEIR EFFECT ON SYSTEM USE, EASE OF USE AND CONFLICTING NEEDS OF NOVICE AND EXPERT USERS, AND MAXIMIZATION OF ACCESSIBILITY VERSUS MINIMIZATION OF SYSTEM IDLE TIME.

#### COMMENTS:

THIS PAPER PRESENTS A FAIRLY GENERAL DISCUSSION OF HUMAN FACTORS PROBLEMS ASSOCIATED WITH THE DESIGN AND USE OF TIME-SHARED SYSTEMS. AT THE TIME THIS PAPER WAS WRITTEN, VERY LITTLE RESEARCH HAD BEEN DONE IN THESE PROBLEM AREAS. THE AUTHORS, THEREFORE, CONCENTRATE ON IDENTIFYING THE IMPORTANT QUESTIONS RATHER THAN ATTEMPTING TO PROVIDE ANSWERS AND GUIDELINES. SOME OF THE PROBLEM AREAS IDENTIFIED IN THIS PAPER ARE DISCUSSED IN MORE DETAIL BY J.R. CARBONELL, J.R. ELKIND, AND R.S. NICKERSON (1968) AND BY R.S. NICKERSON (1969). THE PRESENT PAPER PRESENTS A CLEAR DISCUSSION OF THE PERCEIVED HUMAN FACTORS PROBLEMS ASSOCIATED WITH THE ADVENT OF TIME-SHARED SYSTEMS AND WOULD BE RELEVANT TO THOSE CONCERNED WITH THE HISTORY OF HUMAN FACTORS IN COMPUTER SYSTEMS.

369 GENERAL DISCUSSION ON HUMAN FACTORS IN COMPUTER SYSTEMS
NICKERSON, R.S., & PEW, R.W. OBLIQUE STEPS TOWARD THE HUMAN-FACTORS
ENGINEERING OF INTERACTIVE COMPUTER SYSTEMS (REPORT NO. 2190). CAMBRIDGE,
MASSACHUSETTS: BOLT, BERANEK AND NEWMAN, INC., JULY 1971 (ALSO PUBLISHED
AS APPENDIX IN M.C. GRIGNETTI, D.C. MILLER, R.S. NICKERSON, & R.W. PEW,
INFORMATION PROCESSING MODELS AND COMPUTER AIDS FOR HUMAN PERFORMANCE.
CAMBRIDGE, MASSACHUSETTS: BOLT, BERANEK AND NEWMAN, INC., JUNE 1971). (NTIS
NO. AD 732913)
DESCRIPTION:

THIS PAPER PRESENTS A POTPOURRI OF HUMAN-FACTORS CONSIDERATIONS PERTAINING TO THE DESIGN OF GENERAL-PURPOSE, INTERACTIVE COMPUTER SYSTEMS THAT ARE MEANT TO BE USED BY NONPROGRAMMERS. THE READER IS WARNED THAT IT IS INFORMAL, DISCURSIVE AND OPINIONATED. THE INTENT IS TO IDENTIFY SOME SPECIFIC PROBLEMS, TO OFFER TENTATIVE SOLUTIONS TO A FEW OF THEM, AND MOST IMPORTANTLY, TO STIMULATE MORE THINKING ON THE PART OF BOTH SYSTEM DESIGNERS AND HUMAN-FACTORS SPECIALISTS ALONG THESE LINES. (A) 34P, BR.

#### COMMENTS:

THIS PAPER DISCUSSES VARIOUS ASPECTS OF LANGUAGES, FACILITIES, SERVICES AND THE DYNAMICS OF INTERACTIONS. SOME OF THE COMMENTS, SUCH AS THE INCLUSION OF FAIL-SAFE PROVISIONS TO GUARD AGAINST POTENTIALLY SERIOUS USER MISTAKES AND ERROR MESSAGES THAT VARY WITH THE EXPERIENCE LEVEL OF THE USER, ARE QUITE GOOD. AN ADMITTED OMISSION IN THIS PAPER IS ITS FAILURE TO CITE RELEVANT RESEARCH TO SUPPORT THE PRESENTED OPINIONS. IN MANY OF THE AREAS CONSIDERED, SUCH RESEARCH EXISTS AND ITS INCLUSION WOULD STRENGTHEN THESE DISCUSSIONS AND MIGHT LEAD TO THE DEVELOPMENT OF USEFUL DESIGN CRITERIA FOR INTERACTIVE SYSTEMS. THIS PAPER DOES IDENTIFY, HOWEVER, SEVERAL ISSUES THAT SHOULD BE TAXEN INTO CONSIDERATION WHEN DESIGNING INTERACTIVE SYSTEMS, ESPECIALLY FOR THE NOVICE USER.

37D EFFECTS OF CHARGING ALGORITHMS ON USERS
NOLAN, R.L. EFFECTS OF CHARGEOUT ON USER/MANAGER ATTITUDES. COMMUNICATIONS
OF THE ACM, 1977, 20, 177-185.
DESCRIPTION:

THE RELATIONSHIP OF INTERNAL PRICING SYSTEMS FOR COMPUTER SERVICES (CHARGEOUT SYSTEMS) AND USER MANAGEMENT ATTITUDES ABOUT THEIR COMPUTER-BASED INFORMATION SYSTEMS IS INVESTIGATED. EVIDENCE IS PROVIDED THAT THE RELATIONSHIP CONFORMS TO A GENERAL PATTERN THAT WOULD BE EXPECTED FROM THE HYPOTHESIS OF THE FOUR STAGES OF EDP GROWTH. THE RESULTS ALSO INDICATE THAT THE CHARGEOUT SYSTEMS CHARACTERISTIC OF ADVANCED EDP STAGE ENVIRONMENTS ARE ASSOCIATED WITH RELATIVELY HIGH LEVELS OF POSITIVE USER ATTITUDES AND MARKED INCREASES IN EDP TRAINING FOR USERS. BOTH FACTORS ARE IMPORTANT TO THE USER/MANAGER INVOLVEMENT NECESSARY FOR EFFECTIVE CONTROL OF COMPUTERBASED SYSTEMS. DEVELOPMENT AND MAINTENANCE OF COMPUTERBASED SYSTEMS IS ASSERTED TO BE A CATEGORY OF ORGANIZATION CHANGE. A "FELT NEED" FOR THE CHANGE ON THE PART OF THE USER/MANAGER IS PREREQUISITE TO ANY CHANGE TAKING PLACE. THE RESEARCH METHODS OF BEHAVIORAL SCIENCE ARE APPLIED TO INVESTIGATE THE USER/MANAGER ENVIRONMENT AND THE EFFECTS OF CHARGEOUT. (A) 9P, 22R.

COMMENTS:

INTUITIVELY, IT WOULD BE EXPECTED THAT CHARGING ALGORITHMS WOULD EFFECT USERS' ATTITUDES AND SYSTEM USE. THE EFFECT OF CHARGING ALGORITHMS ON SYSTEM USE WAS DEMONSTRATED BY R.S. NICKERSON, J.I. ELKIND, AND J.R. CARBONELL (1968). THE PRESENT PAPER IS AN INADEQUATE INVESTIGATION OF THE EFFECTS OF CHARGING ALGORITHMS. IN FACT, CHARGING ALGORITHMS WERE NOT DIRECTLY CONSIDERED; RATHER, THE AUTHOR CLASSIFIED CHARGING ALGORITHMS ON THE BASIS OF DATA PROCESSING EXPENDITURES, USING A THEORY THAT HE HAD PROPOSED PREVIOUSLY. VERY LITTLE EVIDENCE IS PRESENTED TO SUGGEST A RELATION BETWEEN CHARGING ALGORITHMS AND ATTITUDES OR TO SUPPORT THE AUTHORS HYPOTHESIS OF "FOUR STEPS OF EDP GROWTH" WHICH IS APPARENTLY A CENTRAL CONCEPT OF THIS INVESTIGATION.

371 TACTILE INPUT AND OUTPUT DEVICES

NOLL, A.M. MAN-MACHINE TACTILE COMMUNICATION. SID JOURNAL, JULY/AUGUST 1972, 1(2), 5-11.

DESCRIPTION:

A THREE-DIMENSIONAL TACTILE DEVICE WAS BUILT USING POTENTIOMETERS TO SENSE THE POSITION OF THE DEVICE. TWO-PHASE INDUCTION MOTORS WERE USED TO CONTROL THE FORCE BETWEEN THE USER'S HAND AND THE DEVICE. SUITABLE FORTRAN-COMPATIBLE SOFTWARE WAS WRITTEN FOR CONTROLLING THE MOTORS IN THIS TACTILE DEVICE. OTHER PROGRAMS WERE WRITTEN TO SIMULATE OBJECTS AND SURFACES AND ALSO TO POSITION THE DEVICE AT A SPECIFIED POINT. RESULTS THUS FAR SUGGEST THAT TACTILE MAN-MACHINE COMMUNICATION IS USEFUL FOR "DEPICTING" SURFACES AND OBJECTS WHICH WOULD BE VIRTUALLY IMPOSSIBLE TO DISPLAY VISUALLY. MAN-MACHINE TACTILE COMMUNICATION ALSO HAS POTENTIAL AS A PRACTICAL SCHEME FOR COMPUTER "GRAPHICS" FOR THE BLIND. (A)

8P, 10R.

THIS PAPER CONCENTRATES PRIMARILY ON THE TECHNICAL DETAILS OF A THREE-DIMENSIONAL TACTILE DEVICE, ALTHOUGH THE AUTHOR ALSO BRIEFLY DESCRIBES USERS' EXPERIENCES WITH SUCH A DEVICE AND SUGGESTS APPLICATIONS AND AREAS WHERE ADDITIONAL RESEARCH IS NEEDED. TACTILE INPUT/OUTPUT DEVICES COULD POTENTIALLY BE VERY USEFUL. AS THE AUTHOR NOTES, TACTILE DEVICES COULD DISPLAY OBJECTS THAT COULD BE VERY DIFFICULT, OR IMPOSSIBLE, TO DISPLAY VISUALLY. TACTILE DEVICES WOULD ALSO PROVIDE THE USER WITH AN ADDITIONAL INFORMATION CHANNEL FOR PROCESSING INFORMATION. MOST DISPLAY DEVICES ARE PRIMARILY VISUAL. IT MAY BE POSSIBLE TO OVERLOAD THE USER'S VISUAL INFORMATION PROCESSING CHANNEL MITHOUT OVERLOADING HIS TOTAL INFORMATION PROCESSING CAPABILITY. THUS, PROVIDING AN ADDITIONAL INFORMATION CHANNEL MAY ALLOW THE USER TO EFFECTIVELY PROCESS MORE INFORMATION THAN WOULD BE PROCESSED THROUGH A SINGLE CHANNEL.

372 INFORMATION RETRIEVAL DIALOGUE FOR INEXPERIENCED USER
NOVELL, M. AN INFORMATION RETRIEVAL SYSTEM FOR THE INEXPERIENCED-EXPERIENCED
USER: HOW A USER WOULD VIEW THE SYSTEM. IN A.B. TONIK (ED.), INFORMATION
RETRIEVAL: THE USER'S VIEWPOINT; AN AID TO DESIGN. FOURTH ANNUAL NATIONAL
COLLOQUIUM ON INFORMATION RETRIEVAL. PHILADELPHIA, PENNSYLVANIA: INTERNATIONAL
INFORMATION, 1967, 61-76.
DESCRIPTION:

THIS PAPER DESCRIBES AN INFORMATION RETRIEVAL SYSTEM THAT WAS DESIGNED TO ACCOMPLISH TWO BASIC PURPOSES: (1) TO PROVIDE THE NECESSARY SOPHISTICATION THAT AN EXPERIENCED USER NEEDS TO PERFORM HIS TASK EFFICIENTLY, AND (2) TO ALLOW THE INEXPERIENCED USER TO SUCCESSFULLY USE THE SYSTEM FROM HIS FIRST ENCOUNTER. THE INEXPERIENCED USER CAN REQUEST TUTORIALS THAT WILL EXPLAIN ADDITIONAL SYSTEM CAPABILITIES THAT ALLOW HIM TO MORE EFFICIENTLY UTILIZE THE SYSTEM.

16P, OR.

THIS IS A VERY BRIEF DESCRIPTION OF A PROPOSED INFORMATION RETRIEVAL SYSTEM. THIS SYSTEM INCORPORATES A CRT, KEYBOARD, LIGHTPEN, FUNCTION KEYS, AND USER-DEFINED PROGRAM KEYS. THE MAIN PORTION OF THIS PAPER IS A DESCRIPTION OF A TENTATIVE INTERACTION BETWEEN THE SYSTEM AND AN INEXPERIENCED USER. THE DIALOGUE IS, IN GENERAL, CONSISTENT WITH HUMAN FACTORS GUIDELINES, AND DOES NOT APPEAR TO BE DIFFICULT TO IMPLEMENT.

373 ERRORS IN DATA ENTRY
OBERMAYER, R.W. ACCURACY AND TIMELINESS IN LARGE-SCALE DATA-ENTRY SUBSYSTEMS.
IN PROCEEDINGS OF THE 21ST ANNUAL MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1977, 173-177.
DESCRIPTION:

ERRORS GENERATED AT THE INPUT TO AUTOMATED INFORMATION SYSTEMS THREATEN THE UTILITY OF THE OUTPUTS PRODUCED BY SUCH SYSTEMS -- I.E., THE CLASSIC GIGO (GARBAGE IN -- GARBAGE OUT) PROBLEM. LARGE AMOUNTS OF EFFORT AND ATTENDANT COSTS ARE INVOLVED IN DEALING WITH THESE ERRORS ONCE THEY ARE IN THE SYSTEM; HOWEVER, MORE ATTENTION SHOULD BE GIVEN TO A COORDINATED SOLUTION OF THE PROBLEM AT THE SOURCE -- THE DATA ENTRY POINT. A LARGE-SCALE DATA-ENTRY SUBSYSTEM MODEL IS PRESENTED, TOGETHER WITH STATISTICS ON ERROR AND TIMELINESS. THE CONCEPT OF A SOURCE DATA ENTRY MODULE (SDEM) IS PRESENTED ALONG WITH CONSIDERATIONS OF DESIGN CRITERIA AND A DESIGN APPROACH. AN EXAMPLE IS GIVEN, PARALLELING A TESTBED FOR WHICH DATA COLLECTION IS PLANNED. IT IS SUGGESTED THAT A GENERALIZED SDEM DESIGN MAY BE ACHIEVEABLE, PROVIDING A BASIS FOR THE SOLUTION OF A WISE RANGE OF AUTOMATED INFORMATION SYSTEM DATA ENTRY PROBLEMS. (A)

COMMENTS:

THE AUTHOR NOTES THAT ERRORS ARE A SERIOUS PROBLEM IN INFORMATION SYSTEMS, THAT THERE IS, IN GENERAL, NO SOLUTION TO THIS PROBLEM, AND THAT MOST ERRORS CAN BE TRACED TO SOURCE DATA ENTRY. THE METHOD PROPOSED IN THIS PAPER INVOLVES AN INTERACTIVE SYSTEM TO DETECT AND CORRECT, OR INDICATE THAT CORRECTION IS NEEDED, AT THE TIME THE DATA IS ORIGINALLY INPUT, BUT BEFORE IT IS INTEGRATED INTO THE DATA BASE. THE SUCCESS OF SUCH A SYSTEM DEPENDS ON THE EFFECTIVENESS OF COMPUTERIZED ERROR CHECKING ROUTINES, WHICH IS A FUNCTION OF THE TYPE OF ERRORS INVOLVED. FOR EXAMPLE, M. H. STRUB (1975) REPORTED THAT OVER 80% OF ERRORS IN A TACTICAL DATA ENTRY TASK COULD NOT BE DETECTED BY SUCH ROUTINES. THUS, ALTHOUGH THE SYSTEM PROPOSED IN THIS PAPER MAY BE EXTREMELY USEFUL IN SOME SITUATIONS, IT MAY NOT BE UNIVERSALLY APPLICABLE AND A CAREFUL ANALYSIS OF ERRORS IS A NECESSARY PREREQUISITE TO IMPLEMENTING THIS SYSTEM.

374 ROLE OF HUMAN FACTORS IN COMPUTER SYSTEM DESIGN
O'DIERNO, E.N. DESIGNING COMPUTER SYSTEMS FOR PEOPLE. IN R.E. GRANDA & J.M.
FINKELMAN (EDS.), THE ROLE OF HUMAN FACTORS IN COMPUTERS: PROCEEDINGS OF A
SYMPOSIUM CO-SPONSORED BY THE METROPOLITAN CHAPTER OF THE HUMAN FACTORS SOCIETY
AND BARUCH COLLEGE, CITY UNIVERSITY OF NEW YORK. NEW YORK: HUMAN FACTORS
SOCIETY, METROPOLITAN CHAPTER, 1976, 38-50.
DESCRIPTION:

THE PRIMARY FUNCTION OF MOST HUMAN FACTORS PEOPLE IN DEALING WITH COMPUTING SYSTEMS IS TO OPTIMIZE THE MAN/MACHINE INTER-RELATIONSHIP TO PRODUCE THE MOST EFFICIENT OPERATING ENVIRONMENT FOR BOTH. THOUGH I HAVE NO DESIRE TO INCUR THEIR WRATH, I MUST SAY THAT IT HAS OFTEN BEEN MY EXPERIENCE THAT THE MOST EFFECTIVE SYSTEMS ARE THOSE WHICH DO NOT INVOLVE PEOPLE. IF THERE WAS SUCH A THING AS THE TEN COMMANDMENTS OF COMPUTER SYSTEMS DESIGN, THE FIRST MIGHT BE TO EXCLUDE, ELIMINATE OR MAKE UNNECESSARY ANY FORM OF HUMAN INTERACTION. WITH ALL OTHER FACTORS CONSTANT, THE PERFORMANCE OF THE SYSTEM WILL INCREASE IN INVERSE PROPORTION TO THE AMOUNT OF HUMAN INTERACTION REQUIRED. HOWEVER, SINCE SUCH SYSTEMS ARE RARE IN AN ENVIRONMENT REPLETE WITH PEOPLE, HUMAN FACTORS CONCERNS ARE OF SUBSTANTIAL CONSEQUENCE. (A) 13P, DR.

COMMENTS:

THIS IS A VERY HEGH-LEVEL DISCUSSION OF THE ROLE OF HUMAN FACTORS IN COMPUTER SYSTEM DESIGN, IMPLEMENTATION, AND OPERATION. AFTER POSTULATING SOME REASONS WHY SYSTEM DESIGNERS TEND TO IGNORE HUMAN FACTORS, PRIMARILY DUE TO THE LACK OF QUANTITATIVE, OBJECTIVE BATA, TWO BRIEF CASE STUDIES THAT ILLUSTRATE POSITIVE RESULTS FROM CONSIDERING HUMAN FACTORS ASPECTS ARE PRESENTED. ALTHOUGH THESE CASE STUDIES MAY BE INTERESTING, THEY DO NOT BY THEMSELVES MAKE A CONVINCING CASE TO SUPPORT THE NECESSITY OF HUMAN FACTORS CONSIDERATIONS IN SYSTEM DESIGN. THE REASONS GIVEN FOR THE GENERAL DISREGARD OF HUMAN FACTORS BY SYSTEM DESIGNERS ARE SOMEWHAT MORE INTERESTING AND SUGGEST THE DESIRABILITY OF A USEABLE HANDBOOK TO GUIDE THE SYSTEM DESIGNER IN IDENTIFYING AND RESOLVING POTENTIAL HUMAN FACTORS PROBLEMS.

375 EVOKED CORTICAL POTENTIALS AS DISPLAY EVALUATION TECHNIQUE

O'DONNELL, R.D., & SPICUZZA, R.J. VISUALLY EVOKED BRAIN POTENTIALS AS AIDS IN

DISPLAY DESIGN (REPORT NO. AMRL-TR-77-58). WRIGHT-PATTERSON AFB, OHIO:

AEROSPACE MEDICAL RESEARCH LABORATORY, AEROSPACE MEDICAL DIVISION, AIR FORCE
SYSTEMS COMMAND, AUGUST 1977. (NTIS NO. AD A043853)

DESCRIPTION:

THE ELECTRICAL ACTIVITY OF THE BRAIN IN RESPONSE TO A VISUAL SCENE IS BEING USED AS AN ADJUNCT TO MEASUREMENT TECHNIQUES IN SEVERAL HUMAN ENGINEERING AND MEDICAL APPLICATIONS. RECORDED FROM ELECTRODES PLACED ON THE SUBJECT'S SCALP, THIS "EVOKED POTENTIAL" SENSITIVELY MEASURES THE WAY THE HUMAN RESPONDS TO DIFFERING PRESENTATIONS OF THE OUTSIDE WORLD. IT PERMITS EVALUATION OF THE EFFECTS OF CHANGES IN THE SENSORY QUALITIES OF A DISPLAYED SCENE, AS WELL AS THE COGNITIVE DEMANDS AND RESPONSE REQUIREMENTS OF A SPECIFIC TASK. AS SUCH, THE EVOKED POTENTIAL PROVIDES A UNIFIED METRIC THAT ALLOWS THE ENGINEERING PSYCHOLOGIST TO ASSESS THE TOTAL REQUIREMENTS PLACED ON THE SUBJECT, FROM SENSORY INPUT TO MOTOR OUTPUT. SEVERAL STUDIES ARE REPORTED USING THIS TECHNIQUE TO ANSWER QUESTIONS OF DISPLAY DESIGN AND OPERATOR PERFORMANCE. FOR THE FUTURE, IMPROVEMENTS IN RECORDING AND ANALYSIS SHOULD ALLOW THIS TECHNOLOGY TO MOVE FROM THE LABORATORY TO THE FIELD, AND PERMIT RAPID' ASSESSMENT OF SUCH SUBJECTIVE FACTORS AS FATIGUE, ATTENTION, PSYCHOLOGICAL DISTRESS AND OTHER POTENTIALLY DANGEROUS OPERATOR STATES. (A) 11P, 12R.

COMMENTS:

MEASURING EVOKED POTENTIALS IS A NEW, EXTREMELY SENSITIVE TECHNIQUE FOR PERFORMANCE MEASUREMENT. THE REPORTED EXPERIMENTS INDICATE THAT IT IS FAR MORE SENSITIVE, AND PRESUMABLY MORE ACCURATE, FOR ASSESSING THE EFFECTS OF VISUAL DISPLAYS ON INFORMATION PROCESSING THAN REACTION TIME OR SUBJECT-PREFERENCE MEASURES. IN COMPARING DOT AND STROKE LETTER DISPLAYS, FOR EXAMPLE, THE AUTHORS REPORT A SIGNIFICANT ENCODING TIME DIFFERENCE OF BETWEEN FOUR AND TEN MILLISECONDS THAT WAS NOT DETECTABLE IN A SIMPLE REACTION TIME STUDY. THE TECHNOLOGICAL PROBLEMS ASSOCIATED WITH THIS TECHNIQUE, HOWEVER, WILL PROBABLY PREVENT ITS WIDESPREAD USE FOR SOME TIME.

376 CRT DISPLAYS AND WORKPLACES

DESTBERG, D. CRTS POSE HEALTH PROBLEMS FOR OPERATORS. INTERNATIONAL JOURNAL OF OCCUPATIONAL HEALTH AND SAFETY, NOVEMBER-DECEMBER 1975, 44(6), PP. 24-26; 52; 50; 46.

DESCRIPTION:

THIS IS A BROAD REVIEW OF THE HEALTH-RELATED ASPECTS OF CRT DISPLAYS AND TERMINALS, THEIR ASSOCIATED WORKPLACES, VISUAL ENVIRONMENTS, AND TASKS. THE AUTHOR ASSERTS THAT MANY SYMPTOMS, ESPECIALLY OCULAR AND VISUAL FATIGUE, HEADACHES, AND POSTURAL FATIGUE, RESULT FROM CURRENT PRACTICES. BETTER ATTENTION TO LIGHT LEVELS, DISPLAY PROPERTIES, TASK PROPERTIES, DIALOGUE PROPERTIES, WORKPLACE DESIGN, GLARE, LUMINANCE CONTRAST, FLICKER, DISPLAY COLOR, AND CHARACTER CONTOUR SHARPNESS, AMONG OTHER THINGS, SHOULD ALLOW US TO IMPROVE THIS SITUATION.

7P, 62R.

THIS IS AN EXCELLENT REVIEW, WHICH SUCCESSFULLY INTEGRATES A WIDE RANGE OF RESEARCH FINDINGS AND IDEAS. NO DATA ARE PRESENTED CONCERNING EITHER THE INCIDENCE OF THE CITED PROBLEMS OR THE PROBABLE EFFICACY OF THE PROPOSED COUNTERMEASURES, BUT IT IS CONVINCING NONETHELESS. THE PAPER IS RELEVANT TO THOSE CONCERNED WITH VIRTUALLY ANY FUNCTIONAL ASPECT OF CRT-BASED SYSTEMS.

OESTBERG, O. OFFICE COMPUTERISATION IN SWEDEN: WORKER PARTICIPATION, WORKPLACE DESIGN CONSIDERATIONS, AND THE REDUCTION OF VISUAL STRAIN. PAPER PRESENTED AT NATO ADVANCED STUDY INSTITUTE ON MAN-COMPUTER INTERACTION, MATI, GREECE, SEPTEMBER 1976 (REPRINTED BY DEPARTMENT OF HUMAN WORK SCIENCES, UNIVERSITY OF LULEA, LULEA, SWEDEN). DESCRIPTION:

THIS PAPER DISCUSSES HEALTH AND SAFETY ASPECTS OF CRT DISPLAYS AND THE ASSOCIATED WORKPLACES. THE INTRODUCTION OF CRT COMPUTER TERMINALS RADICALLY CHANGES THE PHYSICAL AND MENTAL ACTIVITIES OF THE OFFICE WORKER. FAILURE TO CONSIDER THESE CHANGES IN DESIGNING TERMINALS HAS INCREASED THE MUSCLE AND VISUAL STRAIN EXPERIENCED BY USERS. THE CAUSES OF SUCH STRAIN ARE IDENTIFIED AND PRACTICAL SOLUTIONS ARE PROPOSED. PROGRAMS INSTITUTED BY THE SWEDISH GOVERNMENT TO INSURE THAT WORKING CONDITIONS ARE ADAPTED TO HUMAN NEEDS ARE ALSO DESCRIBED.

COMMENTS:

THIS PAPER PROVIDES A GOOD REVIEW OF THE HUMAN FACTORS PROBLEMS, ESPECIALLY VISUAL, INVOLVED IN TERMINAL DESIGN AND UTILIZATION. ALTHOUGH THE SOLUTIONS PROPOSED HERE HAVE NOT BEEN EXPERIMENTALLY VALIDATED, THEY DO SEEM REASONABLE. IN FACT, MOST OF THESE SOLUTIONS HAVE BEEN SPONTANEOUSLY IMPLEMENTED BY TERMINAL OPERATORS. A SIMILAR REVIEW WAS PRESENTED BY O. OESTBERG (1975); THE PRESENT PAPER EXTENDS THIS REVIEW PRIMARILY BY DESCRIBING A FRAMEWORK FOR MORE EFFECTIVE WORKPLACE DESIGN.

378 COLOR CODING OF POWER CONTROL DISPLAYS
OREM, F. COLOR CODING DECISION DATA. DATAMATION, JUNE 1976, 22(6), 60-64.
DESCRIPTION:

THIS ARTICLE DESCRIBES THE CONTROL SYSTEM FOR A VERY LARGE ELECTRICAL POWER GENERATION AND DISTRIBUTION NETWORK. THE CONTROL SYSTEM ITSELF IS LARGE, INVOLVING 15 COMPUTERS, 19 DISPLAY CONSOLES AND NUMEROUS SENSORS AND EFFECTORS, PROVIDING VERY LARGE QUANTITIES OF REAL-TIME DATA TO THE OPERATORS OF THE NETWORK. THE EFFECTIVE USE OF GRAPHICAL DISPLAYS, COLOR CODING, AND A DIALOGUE SPECIFICATION LANGUAGE ARE DISCUSSED.

5P, OR.

COMMENTS:

THIS PAPER DISCUSSES A LARGE ELECTRICAL POWER ADMINISTRATION CONTROL FACILITY IN QUITE A BIT OF DETAIL. A PRINCIPAL ASPECT OF SUCH A FACILITY IS THAT LARGE AMOUNTS OF INFORMATION ARE CONTINUOUSLY DISPLAYED AND UPDATED AND THIS INFORMATION MUST BE PRESENTED IN A FORM THAT ENABLES THE OPERATOR TO MAKE RAPID DECISIONS. THIS ASPECT IS COMMON TO A VARIETY OF INTERACTIVE TASKS. ALTHOUGH THE EXAMPLES PRESENTED ARE CONCERNED WITH ONE SPECIFIC FACILITY, THE TECHNIQUES UNDERLYING THESE EXAMPLES COULD BE USEFUL IN A VARIETY OF SITUATIONS.

379 LOGICAL PROPERTIES OF TERMINALS
OSSANNA, J.F., & SALTZER, J.H. TECHNICAL AND HUMAN ENGINEERING PROBLEMS IN
CONNECTING TERMINALS TO A TIME-SHARING SYSTEM. AFIPS CONFERENCE PROCEEDINGS,
1970, 37, 355-362. (NTIS NO. AD 715204)
DESCRIPTION:

THE TOTAL EFFECTIVENESS OF A TIME-SHARING SYSTEM AND ITS USER COMMUNITY DEPENDS A GREAT DEAL ON THE HUMAN ENGINEERING OF THE SYSTEM-USER INTERFACE SEEM BY THE USER FROM THE VANTAGE POINT OF HIS TERMINAL. WE HAVE CONCENTRATED ON THE FACTORS AFFECTING THE USER'S ABILITY TO PROVIDE INPUT AT THE RATE HE WISHES AND TO CONTROL OUTPUT. SUITABLE INPUT/OUTPUT STRATEGIES CAN ALLOW THE USER TO WORK IN PARALLEL WITH THE COMPUTER. WE HAVE MAINTAINED THAT A COORDINATED DESIGN OF THE TERMINAL, THE TERMINAL CONTROL HARDWARE, THE TERMINAL CONTROL SOFTWARE, THE SYSTEM'S COMMAND STREAM INTERPRETER, THE COMMANDS, AND OTHER PROGRAMS, ARE ALL NECESSARY TO ACHIEVE THE DESIRED GOAL. (A)

COMMENTS:

THIS ARTICLE DISCUSSES THE AUTHORS' VIEW OF SOME SPECIFIC LOGICAL (NOT PHYSICAL) PROPERTIES WHICH SHOULD BE POSSESSED BY TYPEWRITER-LIKE TERMINALS AND THE ASSOCIATED TERMINAL CONTROL HARDWARE AND SOFTWARE.

380 ERRORS IN INFORMATION ENCODING FOR DATA ENTRY
OWSOWITZ, S., & SWEETLAND, A. FACTORS AFFECTING CODING ERRORS (REPORT NO. RM-4346-PR). SANTA MONICA, CALIFORNIA: RAND CORP., APRIL 1965. (NTIS NO. AD 614415)
DESCRIPTION:

THE DEVELOPMENT OF PUNCHED CARD ACCOUNTING MACHINERY AND OF ELECTRONIC COMPUTERS HAS MADE IT DISTURBINGLY CLEAR HOW FALLIBLE HUMAN BEINGS ARE IN RECORDING DATA, PARTICULARLY CODED DATA. CODING ERRORS ARE OFTEN SO NUMEROUS THAT THEY VIRTUALLY INVALIDATE ANY ANALYSIS OF THE PRINTED DATA. AS A STEP TOWARD SOLVING THIS PROBLEM OF CODING ERRORS, A NUMBER OF EXPERIMENTS WERE CONDUCTED IN WHICH HUMAN SUBJECTS CODED A VARIETY OF DATA IN A NUMBER OF WAYS, THE OBJECT BEING TO DETERMINE WHICH METHODS RESULTED IN THE FEWEST ERRORS. (A)

38P, 3R. COMMENTS:

THE EXPERIMENTAL TASK EMPLOYED INVOLVED THE PRESENTATION OF A STIMULUS IN EITHER ALPHA OR NUMERIC FORM, USING THE STIMULUS TO FIND (LOOK UP) THE CORRESPONDING ALPHANUMERIC CODE IN A TABLE, AND THEN TRANSCRIBING THAT CODE. THE INCLUSION OF THE LOOK-UP PHASE MAY RESTRICT THE GENERALITY OF THE REPORTED RESULTS TO SIMILAR TASKS RATHER THAN TO CODING TASKS, IN GENERAL, THAT TEND TO INVOLVE DNLY THE PRESENTATION AND TRANSCRIPTION PHASES. ALTHOUGH THE AUTHORS PRESENT A LARGE NUMBER OF STATISTICAL ANALYSES, THEY CONSIDER EACH INDEPENDENT VARIABLE SEPARATELY AND DO NOT, THEREFORE, ADEQUATELY CONSIDER POSSIBLE INTERACTIONS AMONG THESE VARIABLES. SOME OF THE REPORTED CONCLUSIONS (E.G., SINGLE CHARACTER SUBSTITUTIONS ARE THE LARGEST SINGLE SOURCE OF ERRORS) MAY BE USEFUL IN A VARIETY OF DATA ENTRY ENCODING SITUATIONS.

381 GENERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
PALME, J. INTERACTIVE SOFTWARE FOR HUMANS (REPORT NO. FOA-C10029-M3(E5)).
STOCKHOLM, SWEDEN: SWEDISH NATIONAL DEFENSE RESEARCH INSTITUTE, JULY 1975.
(NTIS NO. PB 245553)

DESCRIPTION:

WHICH ARE THE HUMAN NEEDS THAT ARE AFFECTED BY THE USE OF COMPUTERS? HOW WILL COMPUTERS AFFECT THE HUMANS USING THEM? WHAT KINDS OF COMMUNICATIONS BETWEEN HUMANS WILL THE COMPUTERS CAUSE? HOW CAN COMPUTER SYSTEMS BE DESIGNED TO BETTER SATISFY HUMAN NEEDS? WHAT DESIGN PRINCIPLES SHOULD BE USED FOR SUCH SYSTEMS? WHAT KINDS OF MAN-MACHINE INTERACTION WILL BETTER SATISFY HUMAN NEEDS?

THIS PAPER DISCUSSES THESE PROBLEMS AND PRESENTS VARIOUS METHODS. COMPUTER DRIVEN, COMMAND DRIVEN AND NATURAL LANGUAGE INTERACTION IS DISCUSSED. (A) 57P, 21R.

THE "HUMAN NEEDS" DISCUSSED IN THIS PAPER CONSIST OF ACCEPTANCE BY PEERS, RESOLUTION OF TWO-PERSON CONFLICTS, PERSONAL DEVELOPMENT, AND THE ABILITY TO MODIFY ONE'S ENVIRONMENT. THE AUTHOR ATTEMPTS TO TRANSLATE THESE NEEDS INTO FUNCTIONAL REQUIREMENTS FOR INTERACTIVE SYSTEMS. ALTHOUGH SOME OF THE AUTHOR'S SUGGESTIONS, SUCH AS DETERMINING APPROPRIATE RESPONSE TIME OR TAILORING ERROR MESSAGES TO FIT THE EXPERIENCE LEVEL OF THE USER, ARE USEFUL, THEY HAVE GENERALLY BEEN EXPRESSED MORE CONVINCINGLY BY OTHERS. ADDITIONAL SUGGESTIONS, SUCH AS THE NEED TO INVOLVE USERS IN THE SYSTEM DESIGN PROCESS, ALSO FALL INTO THIS CATEGORY. ALTHOUGH THIS PAPER DOES NOT APPEAR TO MAKE ANY NEW CONTRIBUTIONS TO THE AREA OF INTERACTIVE SYSTEM DESIGN, IT DOES PRESENT, IN A FAIRLY BRIEF FORM, MANY OF THE FAIRLY WELL ACCEPTED PRINCIPLES THAT HAVE BEEN DEVELOPED IN THIS AREA.

BEHAVIORAL RESEARCH FOR INFORMATION RETRIEVAL SYSTEMS

PARKER, E.B. BEHAVIORAL RESEARCH IN THE DEVELOPMENT OF A COMPUTER-BASED

INFORMATION SYSTEM. IN C.E. NELSON & D.K. POLLOCK (EDS.), COMMUNICATION AMONG

SCIENTISTS AND ENGINEERS. LEXINGTON, MASSACHUSETTS: HEATH AND CO., 1970,

281-292.

THIS PAPER DISCUSSES THE BEHAVIORAL RESEARCH EMPLOYED IN THE DEVELOPMENT OF A PARTICULAR COMPUTER-BASED INFORMATION SYSTEM -- THE STANFORD PUBLIC INFORMATION RETRIEVAL SYSTEM (SPIRES). THERE ARE THREE PRIMARY USES FOR BEHAVIORAL RESEARCH IN CONJUNCTION WITH SYSTEM DEVELOPMENT: (1) TO DETERMINE BEHAVIORAL CONSTRAINTS WHICH SHOULD BE TAKEN INTO ACCOUNT BY SYSTEM DESIGNERS, (2) TO PROVIDE SYSTEMATIC USER FEEDBACK DURING BOTH DEVELOPMENT AND OPERATION, AND (3) FOR SYSTEM EVALUATION. THIS PAPER ILLUSTRATES, BY MEANS OF SPECIFIC EXAMPLES TAKEN FROM OUR OWN SYSTEM DEVELOPMENT, THE UTILIZATION OF BEHAVIORAL SCIENCE RESEARCH IN CONNECTION WITH INFORMATION SYSTEM DEVELOPMENT. (A, ABBR.) 12P, OR.

COMMENTS:

THIS PAPER IS PRIMARILY CONCERNED WITH METHODS FOR OBTAINING INFORMATION ON USER NEEDS AND USER ACCEPTANCE. THE METHODS DISCUSSED RANGE FROM LITERATURE REVIEWS AND INTERVIEWS TO INFORMAL OBSERVATIONS OF USER BEHAVIOR. MANY OF THE COMMENTS CONCERNING THE SOURCES FROM WHICH SCIENTISTS SEEK INFORMATION AND TECHNIQUES FOR STUDYING INFORMATION NEEDS ARE ALSO PRESENTED IN E.B. PARKER AND W.J. PAISLEY (1966). THE PRESENT PAPER MAKES SEVERAL GOOD POINTS CONCERNING AUTOMATED INFORMATION RETRIEVAL SYSTEMS AND INFORMATION NEEDS, IN GENERAL.

383 BEHAVIORAL RESEARCH FOR INFORMATION RETRIEVAL SYSTEMS
PARKER, E.B., & PAISLEY, W.J. RESEARCH FOR PSYCHOLOGISTS AT THE INTERFACE OF
THE SCIENTIST AND HIS INFORMATION SYSTEM. AMERICAN PSYCHOLOGIST, 1966, 21,
1061-1071.

DESCRIPTION:

THIS PAPER SUMMARIZES REPRESENTATIVE FINDINGS ON SCIENTISTS USE OF INFORMATION, COMMENTS ON CONCEPTUALIZATION AND THEORY CONCERNING INFORMATION USE, DUSCUSSES SEVEN METHODOLOGIES THAT PROMISE CONTINUED UTILITY FOR INVESTIGATIONS IN THIS AREA, AND SUGGESTS FURTHER RESEARCH THAT PARTICULARLY NEEDS THE ATTENTION OF PSYCHOLOGISTS. (A, ABBR.)
11P, 54R.

COMMENTS:

THIS PAPER CONTAINS A BRIEF, THOUGH DESCRIPTIVE, REVIEW OF RESEARCH ON INFORMATION SYSTEM USE. MUCH OF THIS LITERATURE CONSISTS OF REPORTS OF UNCONTROLLED STUDIES AND, ACROSS STUDIES, NO COHERENT PATTERN OF RESULTS IS APPARENT. THE LITERATURE IN OTHER AREAS OF MAN-COMPUTER INTERACTION EXHIBITS SIMILAR CHARACTERISTICS AND THE BASIC REASON APPEARS TO BE THE LACK OF WELL-UNDERSTOOD THEORETICAL FRAMEWORKS AND ACCEPTED METHODOLOGIES. THE AUTHORS PROCEED TO DISCUSS SEVERAL METHODOLOGIES THAT ARE APPROPRIATE FOR STUDYING INFORMATION SYSTEM USE AND POINT OUT AREAS WHERE ADDITIONAL RESEARCH IS NEEDED. ONE OF THESE AREAS, THE DETERMINATION OF CRITERION MEASURES, IS A NECESSARY PREREQUISITE FOR SUCH RESEARCH. IN ORDER TO ASSESS HOW WELL A SYSTEM PERFORMS, IT IS NECESSARY TO HAVE SOME CRITERION MEASURES OF HOW THE SYSTEM SHOULD IDEALLY PERFORM. THIS ISSUE HAS BEEN CONSIDERED IN MORE DETAIL BY J.M. MCKENDRY, R.C. WILSON, D.J. MACE, AND J.D. BAKER (1973) IN THE AREA OF TACTICAL INFORMATION SYSTEMS. THIS, AND SIMILAR TECHNIQUES SHOULD BE USEFUL IN A VARIETY OF APPLICATIONS. THE PRESENT PAPER WOULD BE OF PRIMARY INTEREST TO THOSE CONCERNED WITH INFORMATION RETRIEVAL SYSTEMS.

384 GENERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
PARSONS, H.M. THE SCOPE OF HUMAN FACTORS IN COMPUTER-BASED DATA PROCESSING
SYSTEMS. HUMAN FACTORS, 1970, 12, 165-175.
DESCRIPTION:

WORK IN HUMAN FACTORS ENCOMPASSES RESEARCH AND APPLICATION IN HUMAN ENGINEERING, PROCEDURE DEVELOPMENT, TRAINING TECHNIQUES, PERSONNEL REQUIREMENTS, TEST AND EVALUATION, TASK DESCRIPTION, AND TASK ALLOCATION. OPPORTUNITIES AND NEEDS EXIST IN COMPUTER-BASED DATA PROCESSING SYSTEMS FOR ALL THESE ENDEAVORS, ESPECIALLY WITH REGARD TO ON-LINE USERS. WITHIN HUMAN ENGINEERING, ONLY MANUAL ENTRY HAS SO FAR RECEIVED MUCH RESEARCH ATTENTION. WORK IS ALSO NEEDED ON DISPLAYS, INTEGRATED ENTRY-DISPLAY, WORKSPACE AND OTHER EQUIPMENT ASPECTS, ON-LINE LANGUAGES, AND PROGRAM PRODUCTION. OF GREATEST CONCERN TO HUMAN ENGINEERING IS THE COMPUTER OUTPUT, DESIGNED BY PROGRAMMERS, RATHER THAN THE HARDWARE. HUMAN FACTORS PEOPLE WILL HAVE TO MASTER A NEW FIELD AND PROVIDE GUIDANCE TO A NEW DISCIPLINE WHICH HAS NOT YET UNDERSTOOD HUMAN FACTORS REQUIREMENTS. (A)

COMMENTS:

THIS PAPER PROVIDES A BRIEF AND EASY TO READ INTRODUCTION TO THE STUDY OF HUMAN FACTORS FOR COMPUTER-BASED SYSTEM PERSONNEL AND IT PROVIDES A SIMILAR INTRODUCTION TO COMPUTER-BASED SYSTEMS FOR HUMAN FACTORS PERSONNEL. THE AUTHOR THEN PRESENTS A FAIRLY COMPREHENSIVE DISCUSSION OF AREAS IN WHICH HUMAN FACTORS RESEARCH COULD USEFULLY BE APPLIED IN COMPUTER SYSTEMS. THE PAPER IS, THEREFORE, AN EXCELLENT SOURCE OF IDEAS FOR THOSE INTERESTED IN RESEARCH ON HUMAN FACTORS IN COMPUTER SYSTEMS. INCIDENTALLY, SEVERAL PREDICTIONS MADE HERE HAVE SINCE PROVEN QUITE CORRECT.

385 LARGE-SCALE MAN-MACHINE SYSTEM EXPERIMENTS
PARSONS, H.M. MAN-MACHINE SYSTEM EXPERIMENTS. BALTIMORE: THE JOHNS HOPKINS
PRESS, 1972.
DESCRIPTION:

IN THE LAST TWO DECADES A SUBSTANTIAL AMOUNT OF RESEARCH HAS BEEN CONDUCTED, WHICH, FOR MANT OF A BETTER TERM, MAY BE CALLED "MAN-MACHINE SYSTEM EXPERIMENTS." THESE HAVE BEEN LARGE-SCALE EXPERIMENTS IN WHICH HUMAN SUBJECTS HAVE INTERACTED WITH MACHINES AND EACH OTHER IN COMPLEX SYSTEM SETTINGS BASED TO A CONSIDERABLE EXTENT ON SIMULATION. LABORATORY FACILITIES, SOME OF THEM ELABORATE, HAVE BEEN CREATED FOR THIS PURPOSE. IN SOME CASES, KNOWLEDGE WAS SOUGHT CONCERNING THE MANNED OPERATION OF A PARTICULAR SYSTEM OR SYSTEM COMPONENT. IN OTHERS, THE AIM WAS TO DISCOVER HOW HUMAN BEINGS FUNCTION IN SUCH SYSTEM ENVIRONMENTS.

THIS EXPERIMENTATION HAS HAD CHARACTERISTICS IN COMMON WITH OTHER KINDS OF RESEARCH MORE FAMILIAR TO BEHAVIORAL SCIENTISTS. IT HAS DIFFERED NOT THROUGH THE INCLUSION OF ANY UNIQUE ASPECT BUT THROUGH A COMBINATION OF SEVERAL ASPECTS. AS A HYBRID TYPE OF RESEARCH, MAN-MACHINE SYSTEM EXPERIMENTATION HAS NEITHER BEEN CLAIMED BY THE MORE TRADITIONAL TYPES OF RESEARCHERS AS THEIR OWN NOR BECOME WIDELY KNOWN THROUGH PUBLICATION IN JOURNALS OR PRESENTATIONS AT PROFESSIONAL MEETINGS.

THE MAIN PURPOSE OF THIS BOOK IS TO HELP FUTURE EXPERIMENTERS CONDUCT MAN-MACHINE SYSTEM EXPERIMENTS. NO GUIDEBOOK EXISTS. THIS BOOK DESCRIBES 2D EXPERIMENTAL PROGRAMS. IN THE DESCRIPTIONS OF THESE PROGRAMS, PRIME EMPHASIS IS PLACED ON HOW RESEARCHERS HAVE GONE ABOUT THEIR TASKS.

(A, ABBR.)

645P, 500R.

THE AUTHOR PRESENTS OBJECTIVE SUMMARIES AND CRITIQUES OF A VARIETY OF RESEARCH PROJECTS CONDUCTED DURING THE 1948-1970 TIME FRAME. THIS TEXT WOULD BE AN EXCELLENT SOURCE BOOK OR INTRODUCTION TO MAN-MACHINE SYSTEM EXPERIMENTS. THERE IS A HEAVY EMPHASIS ON EXPERIMENTAL METHODOLOGY. THIS IS APPROPRIATE SINCE AN APPROPRIATE METHODOLOGICAL FRAMEWORK IS A NECESSARY COMPONENT OF A COHERENT RESEARCH PROGRAM. THEORETICAL FRAMEWORKS ARE EQUALLY IMPORTANT BUT ARE OUTSIDE THE SCOPE OF THIS TEXT. THIS IS NOT A CONCISE, STEP-BY-STEP GUIDE TO THE CONDUCT OF RESEARCH; SUCH A GUIDEBOOK MAY NEITHER BE PRACTICAL OR FEASIBLE. IT IS, HOWEVER, A SIGNIFICANT CONTRIBUTION TO THE AREA OF MAN-MACHINE STUDIES.

PARSONS, H.M., & PERRY, W.E. CONCEPTS FOR COMMAND AND CONTROL SYSTEMS.

(TECHNICAL REPORT TM-WD-227/ODD/DD). FALLS CHURCH, VIRGINIA: SYSTEM DEVELOPMENT CORP., DECEMBER 1965. (NTIS NO. AD 479368)
DESCRIPTION:

"COMMAND AND CONTROL SYSTEM" IS "DEFINED" BY (1) OUTLINING A TENTATIVE MODEL OF THE EMBEDDING "MILITARY PROCESS" CONSISTING OF FIVE "FUNCTIONS" (SENSE, ANALYZE, DECIDE, ACT, COMMUNICATE) AT COMMAND POINTS, WITH EMPHASIS ON THE INTERFACES BETWEEN THESE FUNCTIONS; (2) DESCRIBING EIGHTEEN MILITARY COMMAND AND CONTROL SYSTEMS IN OPERATION OR UNDER DEVELOPMENT; (3) NOTING HOW ANALYSTS HAVE CATEGORIZED THIS KIND OF SYSTEM; AND (4) INDICATING RESEMBLANCES BETWEEN THIS KIND OF SYSTEM AND TWO NOM-MILITARY ORGANIZATIONS. IT IS THEREUPON SUGGESTED THAT THE METHODOLOGY FOR IMPROVING THE DERIVATION OF CONCEPTS FOR COMMAND AND CONTROL SYSTEMS CAN BE IMPROVED BY PROFITING FROM PAST EXPERIENCE CONCERNING FIVE INTER-RELATED "TROUBLE-POINTS" ORIGINATING IN THE CONCEPTS FOR SUCH SYSTEMS: INTERFACES AT FUNCTION AND SYSTEM BOUNDARIES, DATA IMPUT AT THE FRONT END, INTERACTION OF NCISE AND DATA CONVERSIONS, CONSIDERATION OF THE "ANTI-SYSTEM", AND SYSTEM EXERCISING. TWO OF THESE "TROUBLE POINTS" ARE EXAMINED IN SOME DETAIL TO SHOW HOW SUCH ANALYSES "LIGHT CONTRIBUTE FURTHER TO AN IMPROVED METHODOLOGY. OPTIMIZATION OF "ENABLING CONDITIONS" COULD ALSO RESULT IN SUCH IMPROVEMENT. THESE INCLUDE PARTICIPATION OF THE USER, LEARNING THE TASK OF CONCEPTUAL DESIGN, MANAGING THAT TASK, AND LETTING THE SYSTEM EVOLVE. (A) 199P, 61R.

COMMENTS:

THIS IS A VERY BROAD, AND NOT VERY SPECIFIC, DISCUSSION OF THE COMMAND AND CONTROL PROCESS AND COMMAND AND CONTROL SYSTEMS. IT SHOULD BE READ ONLY BY THE READER INTERESTED IN OBTAINING A GENERAL PHILOSOPHICAL OR HISTORICAL PERSPECTIVE ON THE NATURE AND PROBLEMS OF THIS PARTICULAR APPLICATION AREA.

387 CYBERNETIC MODEL OF COMPUTER SYSTEM USER
PASK, G. SOME COMMENTS ON THE ORGANIZATION OF MEN, MACHINES, AND CONCEPTS
(TECHNICAL REPORT AFOSR-65-2666). RICHMOND, SURREY, ENGLAND: SYSTEM RESEARCH
LTD., 1965 (ALSO IN PROCEEDINGS, AMERICAN DOCUMENTATION INSTITUTE WORKING
SYMPOSIUM ON EDUCATION FOR INFORMATION SCIENCE, AIRLIE HOUSE, VIRGINIA,
SEPTEMBER 1965). (NTIS NO. AD 628141)
DESCRIPTION:

PART 1 OF THIS PAPER DESCRIBES ABSTRACT CYBERNETIC MODELS FOR THE DATA PROCESSING ACTIVITIES OF ORGANISMS. IN THE MODEL, AN ORGANISM IS REGARDED AS REDUCIBLE TO MINIMAL COMPONENTS THAT ARE ACTIVE CONTROL SYSTEMS. PART PART 2 OF THE PAPER DISCUSSES RELEVANT FEATURES OF SEVERAL EXPERIMENTS IN THE FIELD OF MAN-MACHINE INTERACTION AND PROVIDES DATA IN SUPPORT OF MODEL HYPOTHESES. THE MODEL POSTULATES A SYSTEM COMPOSED OF A PAIR OF DISTINCT AND GOAL-DIRECTED INDIVIDUAL ORGANISMS Z-ALPHA AND Z-BETA WHICH EXIST IN AN ENVIRON-MENT E. FOR PURPOSES OF DATA PROCESSING AND PROBLEM SOLVING ASPECTS OF Z-ALPHA AND Z-BETA, E IS A SEMANTIC ENVIRONMENT. IN METALANGUAGE, ORGANISM Z IS DESCRIBED AS THE REALIZATION OF A CODE FOR A STABLE, GOAL-DIRECTED AND ACTIVE CONTROL SYSTEM C. THE Z'S LEARN CONCEPTS ABOUT PROBLEM SOLVING.
ADMISSIBLE C'S ARE THEREFORE RESTRICTED TO A CLASS OF HIERARCHICALLY ORGA-NIZED ADAPTIVE CONTROL SYSTEMS C = (C-O, C-1, ...) WHERE THE TERMS O, 1, ... DENOTE LEVELS OF ORGANIZATION. SYSTEM STRUCTURES ARE CONSIDERED IN WHICH Z-ALPHA AND Z-BETA, FOR EXAMPLE, CAN BE VIEWED AS THE USER AND THE LIBRARIAN, RESPECTIVELY, IN AN INFORMATION SYSTEM, E BEING THE CONTENT OF A LIBRARY. A CONSERVATION PRINCIPLE IS INTRODUCED WHICH LEADS TO THE NOTION OF QUANTITA-TIVE MEASURES FOR THE RATE AT WHICH OPERATORS CAN BE APPLIED AND THE AMOUNT OF WORK REQUIRED TO ACHIEVE A GOAL. FOR Z TO BE A STABLE SELF-ORGANIZING SYSTEM, THE CODES AVAILABLE TO Z MUST ALLOW FOR CONTINUED ABSTRACTION OF CLASSES OR OF METHODS, THE LEVEL OF ABSTRACTION AT WHICH ESSENTIAL CODES ARE REALIZED TENDING TO INCREASE. APPLICABILITY OF THIS MODEL TO A COMMONLY ACCEPTED MODEL FOR CELLULAR METABOLISM AND CONTROL AND TO INSTRUCTIONAL SYSTEMS IS SUGGESTED. (A) 21P, 54R.

COMMENTS:

THIS IS A VERY ABSTRACT PAPER. ALTHOUGH SOME EMPIRICAL DATA ARE PRESENTED RELATING THE MODEL TO A COMPUTER-ASSISTED CONCEPT LEARNING TASK, THE PAPER IS PRIMARILY DEVOTED TO A DESCRIPTION OF THE MODEL. FOR THOSE WITH A CYBERNETIC ORIENTATION, SUCH A MODEL MAY PROVIDE A USEFUL CONCEPTUAL FRAMEWORK WITHIN WHICH TO CONSIDER SOME OF THE PROPERTIES OF COMPUTER-AIDED PROBLEM SOLVING.

388 DECISION AIDS FOR TASK FORCE COMMANDER
PAYNE, J.R., BRAUNSTEIN, T.J., KETCHEL, J.M., & PEASE, M.C. A BRIEF SURVEY OF
POTENTIAL DECISION AIDS FOR THE TASK FORCE COMMANDER AND HIS STAFF (RESEARCH
MEMORANDUM NURC-RM-84). MENLO PARK, CALIFORNIA: STANFORD RESEARCH INSTITUTE,
AUGUST 1975. (NTIS NO. AD A016627)
DESCRIPTION:

THIS REPORT DISCUSSES POTENTIAL DECISION AIDS FOR A NAVAL TASK FORCE COMMANDER. THESE AIDS WERE IDENTIFIED BY PERSONNEL WORKING IN THE FIELDS OF DECISION ANALYSIS, OPERATIONS RESEARCH, COMPUTER SCIENCE, AND PSYCHOLOGY. BY ASSESSING THE UTILITY OF THESE AIDS IN RELATION TO THE TYPES OF DECISIONS REQUIRED OF A TASK FORCE COMMANDER, A TENATIVE ORDERING FOR THE DEVELOPMENT OF THESE AIDS IS PROPOSED. 144P, 14R.

COMMENTS:

THE EMPHASIS IN THIS PAPER IS ON POTENTIAL DECISION AIDS FOR A NAVAL TASK FORCE COMMANDER. THESE POTENTIAL AIDS ARE, IN FACT, CONCEPTS THAT PERSONNEL WORKING IN DIFFERENT FIELDS SUGGESTED AS BEING POTENTIALLY USEFUL. THESE CONCEPTS ARE THEN SUBJECTIVELY EVALUATED IN ORDER TO OBTAIN A RANK ORDERING FOR FURTHER STUDY. AS A SOURCE OF IDEAS FOR POTENTIAL DECISION AIDS, THIS PAPER MAY BE USEFUL. IT DOES NOT, HOWEVER, PROVIDE ADEQUATE DESCRIPTIONS OR COMPARISONS OF THE PROPOSED AIDS.

389 REPERTORY GRID TECHNIQUE FOR USER REQUIREMENTS ANALYSIS
PEACE, D.M.S., & EASTERBY, R.S. THE EVALUATION OF USER INTERACTION WITH
COMPUTER-BASED MANAGEMENT INFORMATION SYSTEMS. HUMAN FACTORS, 1973, 15,
163-177.

DESCRIPTION:

THE PAUCITY OF HUMAN FACTORS WORK IN COMPUTER SYTEM DESIGN IS NOTED, AND REASONS FOR THIS ARE ELABORATED WITH PARTICULAR REFERENCE TO COMPUTER-BASED MANAGEMENT INFORMATION SYSTEMS. THE MAIN OBSTACLE TO SUCH HUMAN FACTORS ENDEAVOR WOULD APPEAR TO BE THE LACK OF APPROPRIATE INVESTIGATORY TECHNIQUES. TO REMEDY THIS DEFICIENCY A METHOD IS PROPOSED WHICH DERIVED FROM THE FIELD OF PSYCHOTHERAPY. PILOT STUDIES ARE REPORTED WHICH DEMONSTRATE THE TECHNIQUE AND INDICATE HOW THE DATA OBTAINED MAY BE INTERPRETED. AN APPRAISAL OF THE POTENTIAL OF THIS TECHNIQUE IN THE MANAGEMENT INFORMATION SYSTEM FIELD IS PRESENTED. (A)

THE TECHNIQUE DESCRIBED IS THE REPERTORY GRID TECHNIQUE BASED ON THE PERSONAL CONSTRUCT THEORY OF G.A. KELLY. THE GOAL OF THE TECHNIQUE IS TO DERIVE, FOR AN INDIVIDUAL SUBJECT, A CONCEPTUAL STRUCTURE WHICH REPRESENTS THE PRINCIPLE AXES OF THE COGNITIVE FRAME OF REFERENCE AGAINST WHICH THE SUBJECT EVALUATES IDEAS AND EVENTS IN HIS PROFESSIONAL ENVIRONMENT. THE TECHNIQUE IS CLAIMED TO HAVE POTENTIAL VALUE IN ASSISTING THE SYSTEM DESIGNER IN PERSONALIZING A SYSTEM TO FIT THE NEEDS OF A PARTICULAR MANAGER IN A PARTICULAR PROBLEM SETTING.

15P, 17R.

COMMENTS:

THIS PAPER DESCRIBES AN INTERESTING TECHNIQUE THAT MAY BE A USEFUL SUPPLEMENT TO OTHER METHODS OF USER REQUIREMENTS ANALYSIS. THE RATIONALE UNDERLYING THIS TECHNIQUE IS THAT IN ORDER TO DESIGN AN EFFECTIVE PERSONALIZED SYSTEM, THE DESIGNER MUST KNOW HOW THE POTENTIAL USER VIEWS THE INFORMATION AVAILABLE IN HIS ENVIRONMENT. SPECIFICALLY, THIS TECHNIQUE LEADS TO A CHARACTERIZATION OF THE USER'S PERCEPTIONS IN TERMS OF DICHOTOMOUS DIMENSIONS AND RELATED CLUSTERS OF DIMENSIONS. THE TECHNIQUE DESCRIBED HERE, THOUGH POSSIBLY EFFECTIVE, MAY BE VERY DIFFICULT TO USE. IT REQUIRES THAT THOSE APPLYING THIS TECHNIQUE HAVE SOME KNOWLEDGE OF FACTOR ANALYSIS AND BE ABLE TO SUBJECTIVELY DETERMINE WHAT QUESTIONS WILL BE USED TO ELICIT INFORMATION FROM THE USER AND HOW THIS INFORMATION SHOULD BE GROUPED FOR ANALYSIS. AT THE LEAST, A CERTAIN AMOUNT OF EXPERIENCE AND PRACTICE WOULD BE REQUIRED IN ORDER TO EFFECTIVELY USE THIS TECHNIQUE. THIS PAPER CONTAINS SOME VERY INTERESTING IDEAS THAT WOULD BE RELEVANT TO ANYONE CONCERNED WITH USER REQUIREMENTS ANALYSIS.

393 DOT-MATRIX DISPLAYS

PETERS, G.L., & BARBATO, G.J. INFORMATION PROCESSING OF DOT MATRIX DISPLAYS (TECHNICAL REPORT AFFDL-TR-76-82). WRIGHT-PATTERSON AIR FORCE BASE, OHIO: AIR FORCE FLIGHT DYNAMICS LABORATORY, OCTOBER 1976. (NTIS NO. AD AD36668) DESCRIPTION:

THE LIGHT EMITTING DIODE (LED) DISPLAY TECHNOLOGY PROVIDES THE DISPLAY DESIGNER WITH MANY SOLUTIONS AS WELL AS PROBLEMS IN HIS DESIGN TASK. THE PRESENT STUDIES WERE DESIGNED TO ASSESS THE PERFORMANCE IMPACT OF SYMBOLOGIES COMPOSED OF DISCRETE ELEMENTS RELATIVE TO MORE CONVENTIONAL CONTINUOUS SYMBOLOGIES. IN AN ATTEMPT TO EXAMINE INFORMATION PROCESSING OF VARIOUS COMPONENTS OF BEHAVIOR -- SUCH AS INFORMATION INPUT, CENTRAL PROCESSING AND OUTPUT -- THREE DIFFERENT TASKS WERE SELECTED. A TWO-OR FOUR-ALTERNATIVE CHOICE REACTION TIME TASK DEMONSTRATED AN ABILITY TO MEASURE A DIFFERENCE BETWEEN PUNCTATE AND CONTINUOUS INFORMATION, AND SUGGESTED THAT THE DIFFERENCE IS REDUCED WITH INCREASED TASK COMPLEXITY. A MEMORY SEARCH TASK DEMONSTRATED THE IMPORTANCE OF SYMBOLOGY COMPATIBILITY AND A DISPLAY SEARCH TASK REVEALED EQUAL SEARCH EFFICIENCIES FOR PUNCTATE AND CONTINUOUS ALPHANUMERICS. ADDITIONAL AREAS OF INVESTIGATION ARE DISCUSSED. (A) 32P, 17R.

COMMENTS:

THIS PAPER DESCRIBES AN INTERESTING AND CAREFULLY CONDUCTED SERIES OF EXPERIMENTS. THESE EXPERIMENTS WERE BASED ON PARADIGMS THAT ARE FAIRLY STANDARD IN RESEARCH IN COGNITIVE PSYCHOLOGY AND THE AUTHORS STUDIED VARIABLES THAT HAVE BOTH THEORETICAL AND PRACTICAL IMPORTANCE. THE REPORTED RESULTS ARE CONSISTENT WITH THOSE REPORTED IN THE PSYCHOLOGICAL LITERATURE AND COULD, THEREFORE, BE ACCEPTED AS REAL AND USED IN THE DESIGN OF DISPLAY SYSTEMS.

PERFORMANCE MODELS OF MAN-MACHINE SYSTEMS
PEJ, R.W., BARON, S., FEEHRER, C.E., & MILLER, D.C. CRITICAL REVIEW AND
ANALYSIS OF PERFORMANCE MODELS APPLICABLE TO MAN-MACHINE SYSTEMS EVALUATION
(REPORT NO. 3446). CAMBRIDGE, MASSACHUSETTS: BOLT BERANEK AND NEWMAN, INC.,
MARCH 1977. (NTIS NO. AD A038597)
DESCRIPTION:

THIS REPORT FOCUSES ON THE REVIEW OF POTENTIALLY RELEVANT MODELS AND ON THE IDENTIFICATION OF ISSUES IN MODEL DEVELOPMENT AND APPLICATION THAT MAY HAVE IMPORTANT IMPACT ON MODELS FOR LARGE SCALE MAN-MACHINE SYSTEMS. A DETAILED AND CRITICAL EVALUATION OF SEVERAL CLASSES OF HUMAN PERFORMANCE MODELS IS PRESENTED. INTERRELATIONSHIPS AMONG EXISTING MODELS ARE EXAMINED AND AN EVALUATION IS MADE OF THE NEEDS AND GAPS IN THE TECHNOLOGY. MODELING ISSUES ARE IDENTIFIED AND RESEARCH RECOMMENDATIONS SUGGESTED. APPROXIMATELY FORTY MODELS OR MODEL TECHNIQUES THAT HAVE SOME APPLICABILITY TO THE SIMULATION MODELING PROGRAM ARE DESCRIBED IN THE APPENDIX. (A)

COMMENTS:

THIS IS A VERY GOOD REVIEW OF A VARIETY OF PERFORMANCE MODELS THAT COULD BE USEFUL IN MAN-MACHINE SYSTEMS RESEARCH. ALSO INCLUDED ARE A DISCUSSION OF UNRESOLVED ISSUES SUCH AS MODEL VALIDATION AND DETERMINING THE LEVEL OF DETAIL AT WHICH TO FORMULATE A MODEL, AND RECOMMENDATIONS FOR AN INTEGRATED MODELING EFFORT. THIS IS AN EXCELLENT EXAMPLE OF THE TYPE OF THOROUGH REVIEW AND THEORETICAL ANALYSIS THAT SHOULD PRECEDE LARGE-SCALE, APPLICATION-ORIENTED PROJECTS.

JOSEMBRY AND SPECIFICATION OF MAN-COMPUTER DIALOGUE
PEW, R.W., ROLLINS, A.M., & WILLIAMS, G.A. GENERIC MAN-COMPUTER DIALOGUE
SPECIFICATION: AN ALTERNATIVE TO DIALOGUE SPECIALISTS. IN PROCEEDINGS, 6TH
CONGRESS OF THE INTERNATIONAL ERGONOMICS ASSOCIATION. SANTA MONICA,
CALIFORNIA: HUMAN FACTORS SOCIETY, 1976, 251-254.
DESCRIPTION:

IT HAS LONG BEEN ARGUED THAT MAN-COMPUTER DIALOGUES SHOULD BE WRITTEN BY USER-ORIENTED HUMAN FACTORS SPECIALISTS RATHER THAN BY SYSTEMS DESIGNERS WHO WERE ONCE PROGRAMMERS AND WHO YEND TO THINK LIKE PROGRAMMERS. THE DIFFICULTY IS THAT VERY FEW HUMAN FACTORS SPECIALISTS HAVE ACCESS TO THE DENS OF SYSTEMS DESIGNERS AND EVEN WHEN THEIR USEFULNESS IS RECOGNIZED THERE ARE NOT ENOUGH SUCH SPECIALISTS TO MEET THE NEED. THIS PAPER WILL REPORT ON AN ALTERNATIVE PROCEDURE IN WHICH THE HUMAN FACTORS INPUT IS MADE AT THE STAGE AT WHICH SYSTEM PLANNING IS UNDER WAY, WHEN SYSTEM CHARACTERISTICS ARE SUFFICIENTLY WELL DEFINED THAT IT IS POSSIBLE TO WRITE A DIALOGUE SPECIFICATION, BUT BEFORE SYSTEMS DESIGNERS HAVE BEGUN TO WRITE DIALOGUES. IF THIS SPECIFICATION IS EFFECTIVE, IT WILL GIVE THE DESIGNER FREEDOM TO DO WHAT HE DOES BEST, BUT WILL DO IT WITHIN PREDEFINED CONSTRAINTS THAT WILL PROMOTE THE DEVELOPMENT OF AN EFFECTIVE INTERACTIVE SYSTEM.

IN CONJUNCTION WITH THE DEVELOPMENT OF A LARGE-SCALE MAN-COMPUTER SYSTEM PROPOSED BY THE AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE SUCH A SET OF DIALOGUE SPECIFICATIONS WAS WRITTEN. THE SPECIFICATIONS WOULD PERMIT SEVERAL SYSTEM DESIGN TEAMS TO WORK INDEPENDENTLY, BUT PRODUCE DIALOGUE THAT IS RELATIVELY UNIFORM FROM SUBSYSTEM TO SUBSYSTEM AND THAT MEETS STANDARDS FOR GOOD HUMAN FACTORS DESIGN. THE STEPS UNDERTAKEN TO CREATE THE SPECIFICATION WILL BE DESCRIBED TOGETHER WITH SELECTED SAMPLES OF THE KIND OF DIALOGUE THAT MAY RESULT. (A)

4P, 1R.

ALTHOUGH THE DIALOGUE SPECIFICATION PROCEDURES DESCRIBED IN THIS PAPER ARE NOT OPTIMAL, THEY WERE DEVELOPED UNDER LESS THAN OPTIMAL CONDITIONS AND, FOR THE SITUATION DESCRIBED, APPEAR TO BE QUITE USEFUL. IDEALLY, THE FORM OF MAN-COMPUTER DIALOGUES SHOULD BE DETERMINED BY INTERACTIONS BETWEEN HUMAN FACTORS SPECIALISTS AND THE ULTIMATE USERS OF THE SYSTEM AND SYSTEM SPECIFICATIONS SHOULD BE DEFINED SO AS TO ALLOW FOR THE IMPLEMENTATION OF THE SPECIFIED DIALOGUES. IN THE CASE DESCRIBED IN THIS PAPER, HOWEVER, SYSTEM SPECIFICATIONS WERE DEFINED BEFORE THE SPECIFICATION OF MAN-COMPUTER DIALOGUES WAS INITIATED. SINCE THIS SITUATION IS, UNFORTUNATELY, NOT UNCOMPON IN ACTUAL SYSTEM IMPLEMENTATIONS, THE CONCEPTS EXPRESSED IN THIS APPEAR SHOULD BE VERY USEFUL.

NATURAL-LANGUAGE DIALOGUE PLATH, W.J. RESTRICTED ENGLISH AS A USER LANGUAGE. YORKTOWN HEIGHTS, NEW YORK: IBM WATSON RESEARCH CENTER, NOVEMBER 1972. DESCRIPTION:

THE IDEA OF COMMUNICATING WITH COMPUTERS IN NATURAL ENGLISH HAS CONSIDERABLE INTUITIVE APPEAL, PARTICULARLY AS A POSSIBLE APPROACH TOWARDS MAKING DATA-BASE-ORIENTED SERVICES AVAILABLE TO THE NON-PROGRAMMER USER. RECENT WORK IN THIS AREA HAS SOUGHT TO ESTABLISH A VIABLE MIDDLE GROUND BETWEEN THE INADEQUACY OF MERELY DRESSING UP A FORMAL LANGUAGE TO LOOK LIKE ENGLISH AND THE IMPRACTICABILITY OF TRYING TO HANDLE THE TOTALITY OF "ENGLISH IN THE RAW." A CHARACTERISTIC OF THE EXPERIMENTAL EFFORTS CONSIDERED HERE IS THE USE OF SUBSETS OF ENGLISH WHOSE VOCABULARY AND SEMANTICS ARE SHARPLY RESTRICTED TO CONFORM TO THE LIMITED WORLD OF A SPECIFIC DATA BASE, BUT WHOSE SYNTAX ATTEMPTS TO APPROACH THE FREEDOM OF FULL ENGLISH. AFTER A BRIEF LOOK AT SOME RELEVANT PAST HISTORY, THE PROBLEMS AND PROGRESS OF CURRENT RESEARCH ON COMPUTATIONAL ANALYSIS OF RESTRICTED ENGLISH WILL BE EXAMINED, ALONG WITH ITS POSSIBLE IMPACT ON USER LANGUAGES OF THE FUTURE.

58P, 17R. COMMENTS:

THIS PAPER PROVIDES AN ADEQUATE REVIEW OF THE STATE OF THE ART IN COMPUTER PROCESSING OF RESTRICTED ENGLISH AND OFFERS SOME INTERESTING IDEAS ABOUT THE ULTIMATE USES OF SUCH SYSTEMS. THERE IS NO DISCUSSION, HOWEVER, ABOUT HOW RESTRICTED ENGLISH MIGHT AFFECT THE USER OF SUCH A SYSTEM. AREAS WHERE ADDITIONAL RESEARCH IS NEEDED ARE DISCUSSED.

BIBLIOGRAPHY ON INTERACTIVE GRAPHICS POOCH, U.W. COMPUTER GRAHICS, INTERACTIVE TECHNIQUES, AND IMAGE PROCESSING 1970-1975: A BIBLIOGRAPHY. COMPUTER, AUGUST 1976, 46-64. DESCRIPTION:

COMPUTER GRAPHICS, INTERACTIVE TECHNIQUES, AND IMAGE PROCESSING ARE AMONG THE DEVELOPMENTS IN THE CONSTANTLY EVOLVING COMPUTER SCIENCE FIELD THAT IMPACT THE POTENTIAL USER EVER MORE RAPIDLY. THIS BIBLIOGRAPHY ATTEMPTS TO COMPILE ALL ARTICLES, BOOKS, CONFERENCE PAPERS, AND TECHNICAL REPORTS ABOUT COMPUTER GRAPHICS AND MAN-MACHINE INTERACTION THAT HAVE BEEN PUBLISHED IN ENGLISH FROM 1970 TO 1975. (A) 19P, 683R.

COMMENTS:

THIS IS A VERY LARGE BIBLIOGRAPHY THAT IS CROSS-REFERENCED BY A LIMITED NUMBER OF SUBJECT HEADINGS. ONLY CITATIONS ARE LISTED; THERE ARE NO ABSTRACTS OR COMMENTS ON THE CONTENT OF THE CITED ARTICLES. THIS WOULD BE AN EXCELLENT SOURCE OF REFERENCES ON COMPUTER GRAHICS BUT IT DOES NOT, IN ITSELF, CONVEY ANY INFORMATION ON THIS TOPIC.

395 LEGIBILITY OF TELEPRINTER OUTPUT
POULTON, E.C., AND BROWN, C.H. RATE OF COMPREHENSION OF AN EXISTING
TELEPRINTER OUTPUT AND OF POSSIBLE ALTERNATIVES. JOURNAL OF APPLIED
PSYCHOLOGY, 1968, 52, 16-21.
DESCRIPTION:

THREE-HUNDRED SIXTY-SEVEN ADULTS WERE GIVEN SHORT PASSAGES TO STUDY FOR LIMITED PERIODS OF TIME. THEY THEN HAD TO ANSWER OPEN-ENDED QUESTIONS ON THE CONTENT. A SEPARATE-GROUPS DESIGN, WITH GROUPS OF ABOUT 5C ADULTS AND A GRECO-LATIN-SQUARE DESIGN, USING 96 ADULTS APPEARED TO HAVE ABOUT EQUAL POTENTIAL POWER STATISTICALLY, BUT THE DIFFERENCES BETWEEN COMPARABLE CONDITIONS WERE ALMOST TWICE AS LARGE WITH SEPARATE GROUPS. TEXT TYPED IN PICA COMBINED UPPER- AND LOWER-CASE LETTERS WAS COMPREHENDED ON THE AVERAGE ABOUT 13% MORE RAPIDLY (P<.O2) THAN TEXT IN PICA OR SIEMENS ALL UPPER-CASE LETTERS. THERE WAS LITTLE DIFFERENCE (P>.O5) BETWEEN THE SIEMENS ALL UPPER-CASE; AND LITTLE DIFFERENCE ALSO (P>.O5) BETWEEN THE SIEMENS ALL LOWER CASE, WHICH GAVE INTERMEDIATE RATES OF COMPREHENSION. THE LETTERING OF THE QUESTION SHEETS DID NOT AFFECT THE RESULTS. (A) 6P, 9R.

COMMENTS:

THIS PAPER BRIEFLY REVIEWS PREVIOUS LITERATURE ON PRINTOUT LEGISILITY AND DESCRIBES TWO EXPERIMENTS. THESE EXPERIMENTS APPEAR TO HAVE BEEN CAREFULLY CONTROLLED AND SUPPORT THE FAIRLY GENERAL FINDING THAT TYPE SET IN BOTH UPPER AND LOWER CASE CHARACTERS IS SUPERIOR TO ALL UPPER CASE FORMATS IN BOTH READING SPEED AND COMPREHENSION. THE COMPARISON BETWEEN ALTERNATIVE EXPERIMENTAL DESIGNS IS CONFOUNDED BY DIFFERENCES IN THE EXPERIMENTAL PROCEDURE. THIS IS, HOWEVER, NOT THE PRINCIPAL PURPOSE OF THIS PAPER.

396 MAN-COMPUTER PROBLEM SOLVING
POWERS, J.R. THE INVESTIGATION OF HUMAN DECISION-MAKING BY MEANS OF
MAN-COMPUTER INTERACTION. IN PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON
MAN-MACHINE SYSTEMS, 8-12 SEPTEMBER 1969 (VOL. 3) (IEEE CONFERENCE RECORD NO.
69C58-MMS). NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.,

DESCRIPTION:

1969.

A RESEARCH STUDY WAS CONDUCTED TO DEVELOP PROCEDURES FOR THE INVESTIGATION OF HUMAN DECISION MAKING BY MEANS OF MAN-COMPUTER INTERACTION. OBJECTIVE JAS TO ISOLATE AND DEFINE THOSE VARIABLES WHICH CONTROL OR DETERMINE EFFECTIVE DECISION-MAKING PERFORMANCE. PRIMARY EMPHASIS WAS PLACED ON THE DEVELOPMENT OF PROCEDURES AND COMPUTER PROGRAMS. PRINCIPAL PROCEDURES DEVELOPED DURING THE COURSE OF THE STUDY INCLUDED THE FOLLOWING: (1) GUIDELINES FOR INVESTIGATING HUMAN DECISION-MAKING, BASED ON AN ANALYSIS OF THE BASIC TASKS OF DECISION-MAKERS IN "REAL-WORLD" SYSTEMS; (2) EXPERIMENTAL DECISION-MAKING TASKS (CONSISTENT WITH THE GUIDELINES FORMULATED) THAT PERMITTED CONTROLLED INVESTIGATION OF HUMAN DECISION-MAKING BEHAVIOR. THE TASKS DEVELOPED WERE OF A CONTROL TYPE, REQUIRING THE HUMAN TO EXERT CONTROL OVER THE SYSTEM BY MEANS OF HIS SEQUENTIAL DECISION; (3) ONE OF THESE TASKS WAS PROGRAMMED ON A TIME-SHARING THE COMPUTER SERVED TO ADMINISTER THE EXPERIMENT, SIMULATE THE COMPUTER. SYSTEM BEING CONTROLLED, AND TO COLLECT PERFORMANCE DATA.

A PILOT STUDY WAS CONDUCTED USING THE PROCEDURES AND COMPUTER PROGRAMS DEVELOPED. A TENTATIVE FINDING WAS THAT NON-OPTIMAL DECISION-MAKING PERFORMANCE MAY BE PARTIALLY ACCOUNTED FOR BY SUBJECTS' LACK OF SKILL IN HANDLING SIMULTANEOUSLY SEVERAL FACTORS RELEVANT TO THE DECISION-MAKING PROBLEM. IMPLICATIONS OF THE STUDY FOR FUTURE RESEARCH ARE CONSIDERED. (A) 8P. 1R.

COMMENTS:

THE EXPERIMENTAL TASK USED IN THIS STUDY MAY NOT BE APPROPRIATE FOR A STUDY OF HUMAN DECISION MAKING. THE SUBJECTS' TASK WAS TO DETERMINE INPUTS TO A "BLACK BOX" SYSTEM SO THAT THE COSTS OF THE ASSOCIATED OUTPUTS WERE REDUCED. THIS TASK INVOLVES TWO PHASES. IN THE FIRST PHASE, A SUBJECT MUST DISCOVER THE EQUATION USED BY THE SYSTEM TO RELATE INPUT VALUES TO OUTPUT VALUES. THIS IS VERY SIMILAR TO WHAT IS GENERALLY CALLED "CONCEPT LEARNING." THE FACT THAT SUBJECTS' PERFORMANCE WAS NON-OPTIMAL DUE TO THEIR INABILITY TO SIMULTANEOUSLY CONSIDER SEVERAL RELEVANT FACTORS IS NOT SURPRISING. IN A CONCEPT LEARNING TASK, A SUBJECT INITIALLY DOES NOT KNOW WHICH OR HOW MANY VARIABLES ARE RELEVANT. SUBJECTS, THEREFORE, TEND TO BEGIN WITH VERY SIMPLE HYPOTHESES INVOLVING A SINGLE VARIABLE AND DEVELOP MORE COMPLEX HYPOTHESES ONLY WHEN THIS APPROACH FAILS. AFTER THE CONCEPT IS LEARNED, DECISION-MAKING PROCESSES CAN BE USED TO SELECT INPUTS. QUITE DIFFERENT PROCESSES CAN BE USED IN THE CONCEPT LEARNING AND DECISION-MAKING PHASES OF THIS TASK. GROUPING THESE TWO PHASES TOGETHER TENDS TO OBSCURE RELEVANT ASPECTS OF SUBJECTS' PERFORMANCE. THE EMPHASIS ON MULTI-STEP, OR SEQUENTIAL, DECISION-MAKING, RATHER THAN SINGLE-STEP DECISION-MAKING, HOWEVER, IS GOOD IN THAT IT MORE CLOSELY PARALLELS THE TYPES OF TASKS ENCOUNTERED IN REAL-WORLD SITUATIONS.

397 INTERACTIVE GRAPHICS IN COMPUTER-AIDED ENGINEERING DESIGN
PRINCE, M.D. INTERACTIVE GRAPHICS FOR COMPUTER-AIDED DESIGN. READING,
MASSACHUSETTS: ADDISON-WESLEY, 1971.
DESCRIPTION:

OUR TECHNOLOGICAL COMMUNITY IS ENTERING A NEW ERA OF ENHANCED CREATIVITY AND PRODUCTIVITY MADE POSSIBLE BY COMPUTER-AIDED DESIGN. THIS AUGMENTATION OF THE HUMAN INTELLECT IS A PRODUCT OF MAN-COMPUTER SYNERGISTIC PARTNERSHIP BETWEEN THE MAN AND THE COMPUTER, COMBINING THE BEST QUALITIES OF EACH TO FORM A CAPABILITY OF GREAT POWER. THE PROGRESS EXPECTED IN THIS FIELD DURING THE NEXT DECADE HAS BEEN LIKENED IN MAGNITUDE TO THE PROGRESS ALREADY ACHIEVED BY THE USE OF THE DIGITAL COMPUTER ITSELF SINCE ITS INTRODUCTION.

THIS TEXT DISCUSSES THE HISTORY OF COMPUTER-AIDED DESIGN, PHYSICAL AND FUNCTIONAL PROPERTIES OF GRAPHICS SYSTEMS, PROGRAMMING CONSIDERATIONS, AND APPLICATIONS.
318P, 83R.

### COMMENTS:

THIS TEXT IS PRIMARILY BASED ON THE AUTHOR'S EXPERIENCES AT LOCKHEED. CONSEQUENTLY, MOST OF THE EXAMPLES OFFERED ARE CONCERNED WITH AIRCRAFT DESIGN. THE DISCUSSIONS ARE LARGELY PRACTICAL, RATHER THAN THEORETICAL, AND SHOULD BE EASILY GENERALIZABLE TO A VARIETY OF APPLICATION AREAS. THIS TEXT IS EASILY READ AND PROVIDES A GOOD INTRODUCTION OR OVERVIEW OF COMPUTER GRAPHICS AND COMPUTER-AIDED DESIGN.

398 SIMULATED EXECUTION AS AID TO SYSTEM DESIGN
PROCTOR, J.H. NORMATIVE EXERCISING: AN ANALYTIC AND EVALUATIVE AID IN SYSTEM
DESIGN. IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, 1963, EM-10, 183-192.
DESCRIPTION:

A DYNAMIC SIMULATION OF A MAN-MACHINE INFORMATION SYSTEM HAS BEEN DEVELOPED TO PROVIDE ANALYTICAL AND EVALUATIVE AIDS IN SYSTEM DESIGN, IMPLEMENTATION, AND VERIFICATION. THIS FORM OF ON-SITE SIMULATION IS CALLED "NORMATIVE EXERCISING," BECAUSE OF ITS TWO DISTINGUISHING CHARACTERISTICS:

(1) SPECIFICATION IN ADVANCE OF PREFERRED PROBLEM SOLUTIONS; (2) GUIDANCE OF PLAYER PERFORMANCE INTO PATHS WHICH LEAD TO THE PREFERRED SOLUTION OF THE EXERCISE PROBLEM. REAL-TIME EXERCISING OF A SYSTEM IS ACCOMPLISHED BY CONTROLLING THE INFORMATIONAL INPUTS TO THE SYSTEM THROUGH A SIMULATION CONTROL (SIMCON) TEAM MADE UP OF NONPLAYERS. PERFORMANCE EVALUATION IS OBTAINED BY COMPARING THE ACTUAL EVENTS OF THE EXERCISE WITH THE NORMATIVE SOLUTION PATHS. IT IS EXPECTED THAT NORMATIVE EXERCISING WILL LEAD TO A METHODOLOGICAL APPROACH TO THE STRUCTURE AND MANIPULATION OF INFORMATION IN A COMMAND AND CONTROL SYSTEM AS WELL AS THE HUMAN CAPACITY TO FUNCTION AS A PROBLEM-SOLVER AND DECISION-MAKER. (A) 10P, 20R.

### COMMENTS:

NORMATIVE EXERCISING SHOULD BE AN EFFECTIVE, ALTHOUGH EXPENSIVE, AID TO SYSTEM DESIGN. A PRINCIPAL ADVANTAGE OF THIS TECHNIQUE IS THAT IT REQUIRES CLOSE COOPERATION BETWEEN SYSTEM DESIGNERS AND SYSTEM USERS. THE CONSTRUCTION AND USE OF SIMULATED OPERATIONAL PROBLEMS ENTAILS AN ADDITIONAL ADVANTAGE. THIS REQUIRES THAT THE EVALUATORS AND DESIGNERS OF THE SYSTEM BECOME VERY FAMILIAR WITH THAT SYSTEM AND ITS WINIQUE PROPERTIES. THIS SHOULD IMPROVE THE QUALITY OF THE DESIGN AND THE ACCURACY OF ITS EVALUATION. A SIMILAR APPROACH, CALLED THE NORMATIVE OPERATIONS REPORTING PROCEDURE, IS DISCUSSED BY M.S. SHELDON AND H.J. ZAGORSKI (1967).

399 MAN-COMPUTER PROBLEM SOLVING

PRYWES, N.S. MAN-COMPUTER PROBLEM SOLVING WITH MULTILIST. PROCEEDINGS OF THE IEEE, 1966, 54, 1788-1801. (NTIS NO. AD 646154)

THE PAPER REPORTS ON AUGMENTING HUMAN PROBLEM SOLVING CAPABILITY IN THE DAY-TO-DAY WORK IN MANAGEMENT OR SCIENCE THROUGH PROVISION OF INFORMATION IN A LARGE INTEGRATED FILE WITH SPLIT SECOND RESPONSE TO DEMANDS FOR DATA OR PROGRAM EXECUTION. A NUMBER OF SUCH SYSTEMS HAVE BEEN DEVELOPED. HOWEVER, THE DESCRIPTION IS IN TERMS OF THE LATEST SYSTEM DEVELOPED AT THE UNIVERSITY OF PENNSYLVANIA.

IN THE FIRST PART, THE PAPER DEALS WITH THE MULTILIST TECHNIQUE FOR MASS STORAGE EMBEDDED IN A SYSTEM FOR REMOTE CONSOLES. CONSOLE SERVICES, A HIGH LEVEL QUERY LANGUAGE AND INTERPRETER FOR THE QUERY LANGUAGE, AND A HIGHLY STRUCTURED FILE ORGANIZATION ARE AMONG THE SPECIAL SUBSYSTEMS DESCRIBED.

THE SECOND PART IS DEVOTED TO ILLUSTRATIONS OF USAGES DESCRIBING A NUMBER OF THE APPLICATIONS WHICH CAN BE CONCURRENTLY SERVICED WITHIN THE SYSTEM. THESE INCLUDE: AN AUTOMATIC LIBRARY CATALOG, TO ILLUSTRATE STOPAGE AND RETRIEVAL FUNCTIONS, AND INVENTORY MANAGEMENT, TO ILLUSTRATE LARGE SCALE MANAGEMENT FUNCTIONS. (A) 14P, 14R.

COMMENTS:

THIS PAPER IS PRIMARILY CONCERNED WITH THE HARDWARE AND SOFTWARE NECESSARY TO SUPPORT THE RAPID RETRIEVAL OF INFORMATION FROM A LARGE DATA BASE. THE CENTRAL CONCEPT IS THE USE OF AN ASSOCIATIVE MEMORY THROUGH WHICH INFORMATION CAN BE STORED OR RETRIEVED BY REFERENCE TO COMMON OR INTERACTING ASSOCIATIONS. ASIDE FROM THE RAPID RETRIEVAL CAPABILITY, NO AIDS FOR MANCOMPUTER PROBLEM SOLVING ARE DISCUSSED.

400 MAN-COMPUTER PROBLEM SOLVING

PULFER, J.K. MAN-MACHINE INTERACTION IN CREATIVE APPLICATIONS. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1971, 3, 1-11. DESCRIPTION:

SOME ASPECTS OF CREATIVE ACTIVITY ARE REVIEWED, AND MEANS BY WHICH THE PROCESSES INVOLVED MAY BE AUGMENTED WITH THE HELP OF A DIGITAL COMPUTER ARE DISCUSSED. A COMPUTER AIDED FACILITY FOR WRITING, ARRANGING AND PRODUCING SIMPLE MUSICAL COMPOSITIONS IS DESCRIBED TO ILLUSTRATE THESE CONCEPTS. (A) 11P, 3R.

COMMENTS:

THIS PAPER IS PRIMARILY CONCERNED WITH CREATIVE ACTIVITY AND IT DESCRIBES A SYSTEM TO FACILITATE MUSIC COMPOSITION. IN THIS SYSTEM, THE HUMAN PROBLEM SOLVER TRANSLATES HIS IDEAS INTO A SET OF INSTRUCTIONS AND THE COMPUTER TRANSLATES THESE INSTRUCTIONS INTO MUSIC. MUSIC COMPOSITION IS A CASE WHERE EXECUTING VARIOUS ALTERNATIVES MAY BE TEDIOUS, AND THE COMPUTER, BY EXECUTING THESE ALTERNATIVES, FREES THE HUMAN PROBLEM SOLVER TO ALLOCATE MORE TIME AND RESOURCES TO THE CREATIVE ASPECTS OF PROBLEM SOLVING. ALTHOUGH THIS COMPUTER AID HAS NOT BEEN ADEQUATELY TESTED, IT APPEARS TO BE THEORETICALLY SOUND AND SIMILAR AIDS COULD BE APPLIED IN A VARIETY OF MAN-COMPUTER PROBLEM-SOLVING TASKS.

401 PROBLEMS OF HIGH-LEVEL MILITARY INFORMATION SYSTEMS
RAICHELSON, G. ON-LINE TERMINAL SYSTEMS IN THE MILITARY ENVIRONMENT. IN
PROCEEDINGS OF THE 1972 INTERNATIONAL CONFERENCE ON CYBERNETICS AND SOCIETY.
NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., 1972,
126-128.

DESCRIPTION:

THIS PAPER BRIEFLY DISCUSSES SOPHISTICATED ON-LINE TERMINAL USAGE IN MILITARY SYSTEMS. IT TOUCHES ON SYSTEMS WHERE SUCH USES HAVE BEEN SUCCESSFUL AND POSTULATES THAT ANY LACK OF SUCCESS EXISTS PRIMARILY IN MILITARY INFORMATION SYSTEMS BECAUSE OF THE INADEQUACY OF THE STANDARD SOFTWARE USED AND BECAUSE OF AN UMDEFINED USER NEED THAT RESULTS IN UNDEFINABLE SPECIFIC OPERATOR FUNCTIONS. FINALLY, THE PAPER OFFERS SOME DIFECTIONS THAT SYSTEM DESIGNERS CAN LOOK TOWARD IN DESIGNING SYSTEMS FOR THE MILITARY INFORMATION SYSTEM ENVIRONMENT. (A)

COMMENTS:

THIS AUTHOR CONTENDS THAT, WHILE LDW-LEVEL TACTICAL INFORMATION SYSTEMS HAVE OFTEN SUCCEEDED, HIGH-LEVEL COMMAND AND CONTROL SYSTEMS HAVE OFTEN PROVEN INADEQUATE BECAUSE OF OUR INABILITY TO COPE WITH THEIR RATHER UNPREDICTABLE AND DYNAMIC USER REQUIREMENTS. MOST SUCH SYSTEMS HAVE TAKEN THE FORM OF GENERALIZED SOFTWARE SUPPORT PACKAGES, INCORPORATING GENERALIZED DATA BASE MANAGEMENT SYSTEMS, WITHIN WHICH THE MILITARY ANALYST AND APPLICATION PROGRAMMER DEVELOP WHATEVER SPECIFIC PACKAGES ARE REQUIRED TO SATISFY THE INFORMATION NEEDS OF THE MOMENT. THE AUTHOR SUGGESTS THAT COMPUTER NETWORKS, AND GREATER STANDARDIZATION OF SOFTWARE AND HARDWARE TO ALLOW MORE INTERCHANGABILITY OF OFF-THE-SHELF SOFTWARE ELEMENTS, MAY HELP. HOWEVER, IF THE PROBLEM IS AS BASIC AS THE AUTHOR SUGGESTS, THIS MAY BE A CASE OF TREATING THE SYMPTOMS AND IGNORING THE DISEASE. ANOTHER VIEW WOULD SUGGEST THAT WHAT IS NEEDED ARE MORE POWERFUL TOOLS FOR THE RAPID DEVELOPMENT OF CUSTOMIZED APPLICATION SOFTWARE. IN ANY EVENT, THE BASIC PROBLEM POINTED OUT HERE APPEARS TO BE A PERVASIVE DIFFICULTY, NOT ONLY IN MILITARY COMMAND AND CONTROL, BUT ALSO IN OTHER HIGH-LEVEL INFORMATION SYSTEMS (E.G., MANAGEMENT INFORMATION SYSTEMS IN GENERAL).

402 PHYSICALLY HANDICAPPED USERS
RAITZER, G.A., VANDERHEIDEN, G.C., & HOLT, C.S. INTERFACING COMPUTERS FOR THE
PHYSICALLY HANDICAPPED: A REVIEW OF INTERNATIONAL APPROACHES. AFIPS CONFERENCE
PROCEEDINGS, 1976, 45, 209-216.

DESCRIPTION:

THE COMPUTER HAS SHOWN GREAT PROMISE FOR EXPANDING EDUCATIONAL AND OCCUPATIONAL OPPORTUNITIES FOR SEVERELY HANDICAPPED INDIVIDUALS. THE GREATEST OBSTACLE FACING THESE INDIVIDUALS TODAY IS THAT THEY ARE UNABLE TO ACCESS COMPUTERS THROUGH TRADITIONAL KEYBOARDS OR OTHER TYPES OF TERMINALS. THIS PAPER DESCRIBES THE THREE BASIC TECHNIQUES WHICH HAVE BEEN SUCCESSFULLY USED TO ALLOW THE SEVERELY HANDICAPPED TO COMMUNICATE WITH OTHER PEOPLE AND WITH THEIR ENVIRONMENT. A REVIEW OF OVER 25 VARIOUS APPROACHES WHICH HAVE BEEN DEVELOPED AROUND THE WORLD IS PRESENTED, INCLUDING A COMPREHENSIVE BIBLIOGRAPHY OF AVAILABLE INFORMATION. (A) 8P, 35R.

COMMENTS:

THE COMMUNICATION METHODS OUTLINED HERE ARE ORIENTED PRIMAPILY TOWARD SELECTION OF INDIVIDUAL CHARACTERS, AS IN TYPING, AND CORRESPOND TO SOME OF THE SIMPLER MODERN MAN-COMPUTER DIALOGUE TECHNIQUES. ALTHOUGH SUCH TECHNIQUES ARE UNDOUBTEDLY A GOOD STARTING POINT FOR INTERFACING WITH A HANDICAPPED USER, THEY FAIL TO TAKE FULL ADVANTAGE OF THE AVAILABILITY OF THE COMPUTER'S PROCESSING POWER. IT SEEMS LIKELY THAT SERIOUS EFFORTS IN THIS DIRECTION WOULD RESULT IN MUCH MORE POWERFUL (BUT PROBABLY MORE EXPENSIVE) DEVICES AND, ESPECIALLY, DIALOGUE METHODS. THIS PAPER IS A GOOD BRIEF REVIEW OF ITS INTENDED TOPIC AREA, HOWEVER, AND PROVIDES SOME INSIGHT INTO THE ADVANTAGES AND DISADVANTAGES OF TECHNIQUES REVIEWED (WITHOUT SUPPORTING EXPERIMENTAL DATA) AND INTO THE PROBLEMS OF THE HANDICAPPED USER.

403 SIZE OF PUNCHED CARDS

RAKOWSKI, J.S. EFFECT OF SIZE OF DATA PROCESSING CARDS ON MANUAL HANDLING (REPORT NO. ECOM-2686). FORT MONMOUTH, NEW JERSEY: ARMY ELECTRONICS COMMAND, APRIL 1966. (NTIS NO. AD 632076)

DESCRIPTION:

TWO EXPERIMENTS WERE MADE TO DETERMINE THE EFFECT OF ADP CARD SIZE, THICKNESS, RATIO OF HEIGHT TO WIDTH AND TEXT POSITION ON HANDLING ABILITY. PERFORMANCE TIMES AND ERRORS FOR TWO GROUPS OF SUBJECTS WERE ANALYZED AS WERE SUBJECTS' PERFORMANCES.

RESULTS OF ANALYSIS OF VARIANCE SHOWED THAT PERFORMANCE IMPROVED WITH SMALL, THIN CARDS OF DISTINCT RECTANGULAR SHAPE. TEXT POSITION HAD NO EFFECT ON PERFORMANCE. SUBJECTS GENERALLY PREFERRED THE CARD CONFIGURATIONS WHICH WERE MOST EFFICIENT. (A) 20P, 1R.

COMMENTS:

THIS PAPER REPORTS TWO STRAIGHTFORWARD AND WELL-CONTROLLED EXPERIMENTS. ALTHOUGH DEVELOPMENTS IN THE STATE-OF-THE-ART IN DATA PROCESSING PREVENT THESE RESULTS FROM BEING GENERALIZED TO CURRENT PROBLEMS, THE OVERALL PURPOSE OF THESE EXPERIMENTS IS NOTEWORTHY. CERTAIN ASPECTS OF COMPUTER SYSTEMS, SUCH AS THE DATA PROCESSING CARDS CONSIDERED IN THIS PAPER, MAY BE CONSIDERED BY THE SYSTEM DESIGNER TO BE "TRIVIAL" OR "INSIGNIFICANT" IN VIEW OF THE MORE COMPLICATED ASPECTS OF THE TOTAL SYSTEM. IN THIS CASE, THE DESIGN OF THESE COMPONENTS MAY BE LEFT TO THE CONVENIENCE OF THE MANUFACTURER. ALTHOUGH CARD SIZE AND RELATED ISSUES ARE CERTAINLY NOT THE MOST SERIOUS CONCERNS OF THE SYSTEM DESIGNER, THEY ARE PART OF THE SYSTEM AND COULD POTENTIALLY AFFECT OVERALL SYSTEM PERFORMANCE. AS THIS PAPER ILLUSTRATES, RESEARCH ON SUCH ASPECTS IS FAIRLY INEXPENSIVE AND FAIRLY QUICK TO PERFORM AND COULD BE USEFUL IN OVERALL SYSTEM DESIGN.

404 USER REQUIREMENTS DEFINITION

RAMSEY, H.R. A FORMAL APPROACH TO THE PESIGN OF INTERACTIVE SCHEDULING AND RESOURCE ALLOCATION SYSTEMS. PAPER PRESENTED AT THE MILITARY OPERATIONS RESEARCH SOCIETY 36TH SYMPOSIUM, QUANTICO, VIRGINIA, DECEMBER 1975. DESCRIPTION:

COMPUTER SYSTEMS AND HUMAN SCHEDULERS OFFER QUITE DIFFERENT, AND HIGHLY COMPLEMENTARY, CAPABILITIES FOR SOLVING COMPLEX SCHEDULING AND RESOURCE ALLOCATION PROBLEMS SUCH AS THOSE FOUND IN TYPICAL LOGISTICS MANAGEMENT APPLICATIONS. MODERN MATHEMATICAL PROGRAMMING AND GENERAL-PURPOSE HEURISTIC ALGORITHMS ALLOW VERY LARGE PROBLEMS TO BE ADDRESSED, BUT ARE QUITE RESTRICTIVE WITH RESPECT TO THE RANGE OF CONSTRAINT TYPES WHICH CAN BE MODELED IN THE CONTEXT OF A LARGE PROBLEM. HUMAN SCHEDULERS, ON THE OTHER HAND, ARE CAPABLE OF CONSIDERABLE INSIGHT, AND CAN SUCCESSFULLY DEAL WITH SOFT AND COMPLEX CONSTRAINTS AND MULTIPLE OBJECTIVE FUNCTIONS, BUT, IF UNAIDED, ARE LIMITED TO RELATIVELY SMALL PROBLEMS. THE SOLUTION OF PROBLEMS WHICH ARE BOTH LARGE AND LOGICALLY COMPLEX APPEARS TO REQUIRE A COOPERATIVE UNION OF THESE CAPABILITIES. EXAMPLES ARE GIVEN OF INTERACTIVE OPERATIONAL SCHEDULING AND LOGISTICS SYSTEMS WHICH HAVE FALLEN SHORT OF THEIR DESIGN OBJECTIVES AS A RESULT OF INADEQUATE ATTENTION TO THE COOPERATIVE NATURE OF THIS TASK.

FOR A SPECIFIC INTERACTIVE SYSTEM TO BE EFFECTIVE, IT IS NECESSARY THAT A CAREFUL, DETAILED, AND FORMAL ANALYSIS OF USER REQUIREMENTS, CAPABILITIES, AND LIMITATIONS BE PERFORMED. A METHODOLOGICAL APPROACH TO USER REQUIREMENTS DEFINITION IS OUTLINED, INCLUDING SUCH TECHNIQUES AS: INTERVIEWS, SURVEYS, TASK ANALYTIC METHODS, USER DECISION MODELING, PAPER SIMULATION, INTERACTIVE TASK SIMULATION, AND INTERACTIVE MAN-COMPUTER DIALOG SIMULATION. EXAMPLES OF SUCCESSFUL APPLICATIONS OF THE METHODS ARE PRESENTED, INCLUDING ONE WHICH SUGGESTS A GENERAL DESIGN PHILOSOPHY FOR COOPERATIVE MAN-COMPUTER PROBLEMSOLVING IN THE AREA OF LARGE, LOGICALLY COMPLEX SCHEDULING PROBLEMS. (A) 16P, 2R.

COMMENTS:

IN THIS PAPER, THE AUTHOR ADVOCATES THE USE OF MORE FORMAL METHODS FOR USER REQUIREMENTS DEFINITION FOR INTERACTIVE COMPUTER SYSTEMS, PLACING PARTICULAR EMPHASIS ON SIMULATION AND GAMING TECHNIQUES. BRIEFLY REPORTED CASE STUDIES PROVIDE BOTH GOOD AND BAD DESIGN EXAMPLES, BUT NO HARD DATA OR DETAILS OF THE METHODS ARE PRESENTED. THE "PAPER SIMULATION" METHODS REPORTED ARE SOMEWHAT NOVEL, BUT ALL THE METHODS HAVE BEEN USED BY EARLIER DESIGNERS IN ONE FORM OR ANOTHER. THE PAPER IS APPROPRIATE MAINLY FOR NON-HUMAN-FACTORS PERSONNEL OR AS INTRODUCTORY MATERIAL IN THE USER REQUIREMENTS DEFINITION AREA.

405 INTERACTIVE SOLUTION OF TRANSIT SYSTEM PROBLEM RAPP, M.H. MAN-MACHINE INTERACTIVE TRANSIT SYSTEM PLANNING. SOCIO-ECONOMIC PLANNING SCIENCES, 1972, 6, 95-123. DESCRIPTION:

THE PROBLEM OF FINDING THE BEST FIXED ROUTES FOR NODE ORIENTED TRANSIT SYSTEMS IS USED FOR AN INITIAL IMPLEMENTATION AND EVALUATION OF A MANMACHINE INTERACTIVE PROBLEM SOLVING SYSTEM. THE INTERACTIVE GRAPHIC SYSTEM ENABLES A PLANNER/ANALYST TO EFFECTIVELY SEARCH FOR AND EVALUATE A LARGE NUMBER OF ALTERNATIVE DESIGNS IN A SHORT PERIOD OF TIME. THIS EVALUATION IS BASED ON A MODAL SPLIT MODEL WHICH PREDICTS THE SYSTEM UTILIZATION AND COST CONSEQUENCES OF EACH ALTERNATIVE DESIGN. THE MODEL PERFORMS A DETAILED ANALYSIS OF THE COMPONENTS OF THE TRIP OF EACH POTENTIAL TRIP MAKER BY THE ALTERNATIVE MODES OF TRAVEL BY TRANSIT OR PRIVATE AUTOMOBILE AND IT IS BASED ON VALUES REFLECTING THE AVERAGE TRIP MAKERS PERCEPTION OF DISUTTITITY OF THE VARIOUS TRIP COMPONENTS.

PERCEPTION OF DISUTILITY OF THE VARIOUS TRIP COMPONENTS.

AFTER A CONCEPTUAL DISCUSSION OF THE PROBLEM, THE INTERACTIVE GRAPHIC PROBLEM SOLVING ENVIRONMENT AND THE MODEL UNDERLYING THE PREDICTION PROCESS, THE MECHANICS OF THE ACTUAL IMPLEMENTED SYSTEM ARE DESCRIBED, BOTH IN TERMS OF COMPUTER HARDWARE AND SOFTWARE FEATURES. THE USE OF THE SYSTEM IS THEN ILLUSTRATED WITH A HYPOTHETICAL PROBLEM SITUATION AND THE ABILITY OF THE INTERACTIVE PROCESS TO ASSIST THE RESOLUTION OF CONFLICTING OBJECTIVES AND TO HELP A POLICY MAKING BODY TO REACH COMPROMISES AFTER A VALUE-ORIENTED DISCUSSION. FINALLY, THE PAPER DISCUSSES SOME ISSUES RAISED IN THE PROTOTYPE ANALYSIS RELATIVE TO (1) THE ROLE AND PERFORMANCE OF THE HUMAN IN THE INTERACTIVE PROCESS, (2) ALTERNATIVE SOLUTION GENERATION SCHEMES, AND (3) MODEL CALIBRATION. (A)

COMMENTS:

TRANSIT SYSTEM PLANNING IS SIMILAR TO THE TRAVELLING SALESMAN PROBLEM. AS SUCH, IT IS A PROBLEM THAT CAN EASILY PROVE INTRACTABLE FOR MAN ALONE AND COMPUTATIONALLY INFEASIBLE FOR AUTOMATED SOLUTION. THE SYSTEM PROPOSED HERE IS INTERACTIVE AND THE PRIMARY PROBLEM SOLVING AID IS ONE THAT EVALUATES PROPOSED ALTERNATIVE SOLUTIONS. IN TRANSIT SYSTEM PLANNING, AND A VARIETY OF OTHER TASKS, A VARIETY OF VARIBLES MUST BE CONSIDERED IN ALTERNATIVE EVALUATION AND AN EVALUATION AID CAN BE VERY USEFUL. THIS SYSTEM INCORPORATES AN INTERACTIVE GRAPHICS TERMINAL AND PROVIDES A FAIRLY CONVENIENT MEANS FOR PROPOSING NEW SOLUTIONS OR MODIFYING PREVIOUS SOLUTIONS. COUPLED WITH THE EVALUATION AID, THIS ALLOWS THE USER TO RAPIDLY CONSIDER SOLUTIONS IN A TRIAL-AND-ERROR MANNER. WHEN THE NUMBER OF POTENTIAL SOLUTIONS IS LARGE, HOWEVER, A SYSTEMATIC SEARCH FOR ALTERNATIVES IS PREFERABLE TO A TRIAL-AND-ERROR APPROACH. THIS, AND OTHER, TOPICS ARE SUGGESTED BY THE AUTHOR FOR FURTHER RESEARCH.

406 QUERY LANGUAGES

REISNER, P., BOYCE, R.F., & CHAMBERLIN, D.D. HUMAN FACTORS EVALUATION OF TWO DATA BASE QUERY LANGUAGES: SQUARE AND SEQUEL. AFIPS CONFERENCE PROCEEDINGS, 1975, 44, 447-452.

DESCRIPTION:

A SERIES OF EXPERIMENTS WAS CONDUCTED TO EVALUATE THE LEARNABILITY OF TWO DATA BASE QUERY LANGUAGES, SQUARE AND SEQUEL, USING UNIVERSITY STUDENTS AS SUBJECTS. SUBJECTS WITH OR WITHOUT PROGRAMMING EXPERIENCE WERE ABLE TO USE EITHER PROGRAMMING LANGUAGE WITH REASONABLE PROFICIENCY AFTER 12 OR 14 ACADEMIC HOURS OF INSTRUCTION. PROGRAMMERS LEARNED BOTH LANGUAGES MORE QUICKLY AND MORE COMPLETELY THAN DID NON-PROGRAMMERS, AND THE NON-PROGRAMMERS SHOWED GREATER PROFICIENCY WITH SEQUEL THAN WITH SQUARE. BOTH PROGRAMMERS AND NON-PROGRAMMERS WERE ABLE TO COMBINE BASIC LANGUAGE FEATURES IN WAYS NOT EXPLICITLY TAUGHT.

THE BASIC LANGUAGE FEATURE, A SIMPLE MAPPING, WAS LEARNED IN EACH LANGUAGE WITH NEAR-PERFECT ACCURACY BY PROGRAMMERS AFTER TWO HOURS AND BY NON-PROGRAMMERS AFTER FOUR HOURS. HOWEVER, CONSIDERABLE DIFFICULTY WAS EXPERIENCED IN LEARNING AND RETAINING MORE COMPLEX FEATURES, ESPECIALLY BY NON-PROGRAMMERS. A STUDY OF ERRORS MADE BY SUBJECTS SUGGESTS THAT A REAL DATA BASE SYSTEM SHOULD BE PREPARED TO CORRECT MINOR SYNTACTIC ERRORS AND TO SEARCH FOR POORLY-SPECIFIED DATA VALUES BY SOME TECHNIQUE SUCH AS STEM-MATCHING OR A SYNONYM DICTIONARY. (A,ABBR.)

COMMENTS:

THE INTENT OF THE EXPERIMENT REPORTED IN THIS PAPER WAS TO EVALUATE THE USEABILITY OF TWO QUERY LANGUAGES AND TO COMPARE THESE LANGUAGES. ON THE BASIS OF THE DISCUSSIONS CONTAINED IN THIS PAPER, NEITHER OBJECTIVE IS MET IN AN ENTIRELY SATISFACTORY MANNER. THE AUTHORS CONCLUDE THAT SUBJECTS COULD LEARN TO USE EITHER LANGUAGE WITH REASONABLE PROFICIENCY. THIS IS, OF COURSE, A SUBJECTIVE OPINION, AND IT DOES NOT IMPLY THAT THESE LANGUAGES ARE EITHER MORE OR LESS EFFECTIVE THAN A VARIETY OF ALTERNATIVE QUERY LANGUAGES OR TECHNIQUES. IN ADDITION, THE AUTHORS CONCLUDE THAT ONE QUERY LANGUAGE IS EASIER TO USE THAN THE OTHER, BUT FAIL TO PROVIDE US WITH AN ANALYSIS OF THE LANGUAGE FEATURES THAT MAY BE RESPONSIBLE FOR THIS RESULT. THIS PAPER DOES, HOWEVER, CONTAIN SOME CONCEPTS AND RESULTS THAT MAY BE OF INTEREST TO THOSE CONCERNED WITH QUERY LANGUAGES.

407 BIBLIOGRAPHY ON KEYBOARDS

REMINGTON, R.J., & ROGERS, M. KEYBOARD LITERATURE SURVEY: PHASE I: BIBLIOGRAPHY (TECHNICAL REPORT NO. TR29.0C42). RESEARCH TRIANGLE PARK, NORTH CAROLINA: IBM SYSTEMS DEVELOPMENT DIVISION, FEBRUARY 1969. DESCRIPTION:

THIS REPORT CONSISTS OF A BIBLIOGRAPHY ON THE DESIGN AND USE OF KEYBOARDS. 38P, 375R.

COMMENTS:

THIS REPORT CONTAINS A LARGE NUMBER OF REFERENCES TO THE LITERATURE ON KEYBOARDS. THERE IS NO DISCUSSION OF THE CONTENT OF ANY OF THE CITED REFERENCES. ALTHOUGH THIS BIBLIOGRAPHY DOES NOT CITE PAPERS PUBLISHED SINCE 1969, IT SHOULD STILL BE USEFUL TO THOSE INTERESTED IN KEYBOARD DESIGN AND FACTORS AFFECTING PERFORMANCE WITH KEYBOARDS.

408 MENU-SELECTION DIALOGUE FOR NON-SPECIALIST USER RIDSDALE, B. THE NON-SPECIALIST USER AND THE COMPUTER TERMINAL. IN MAN-COMPUTER INTERACTION (PROCEEDINGS, CONFERENCE ON MAN-COMPUTER INTERACTION, 2-4 SEPTEMBER 1970) (CONFERENCE PUBLICATION NO. 68). LONDON, ENGLAND: INSTITUTION DESCRIPTION:

AT PRESENT, A LARGE PROPORTION OF ALL COMPUTER TERMINAL USERS ARE STAFF WHO ARE TRAINED TO OPERATE THE TERMINALS, AND WHOSE JOB IT IS TO INTERACT DIRECTLY WITH THE COMPUTER. THERE IS A GROWING TENDENCY, HOWEVER, FOR NON-SPECIALIST COMPUTER USERS SUCH AS MANAGERIAL, TECHNICAL AND MEDICAL STAFF TO NEED TO INTERACT WITH THE COMPUTER AS PART OF THEIR JOB. THIS PAPER DESCRIBES AN ATTEMPT AT INTERFACING THE NON-SPECIALIST USER WITH THE COMPUTER TERMINAL, SOME OF THE PROBLEMS MET AND SOLUTIONS FOUND, AND THE PLANS FOR FUTURE DEVELOPMENT. (A)

COMMENTS:

THIS PAPER BRIEFLY DESCRIBES A MENU SELECTION TECHNIQUE FOR ENTERING MEDICAL DATA. MENU SELECTION IS WELL-SUITED FOR NOVICE USERS IN SITUATIONS, SUCH AS THE ONE DESCRIBED IN THIS PAPER, WHERE A LIST OF CHOICES CAN BE DISPLAYED AND THE USER CAN INDICATE HIS CHOICE. THE AUTHOR SPENDS MORE TIME DESCRIBING THIS SPECIFIC SYSTEM THAN IN CONSIDERING THE ADVANTAGES AND DISADVANTAGES OF MENU SELECTION, OR OTHER DIALOGUE TECHNIQUES, IN GENERAL.

409 RESEARCH PROGRAM ON COMMAND AND CONTROL DISPLAYS
RINGEL, S. COMMAND INFORMATION PROCESSING SYSTEMS: A HUMAN FACTORS RESEARCH
PROGRAM (TECHNICAL REPORT 1148). #ASHINGTON, D.C.: ARMY PERSONNEL RESEARCH
OFFICE, JUNE 1966. (NTIS NO. AD 637814)
DESCRIPTION:

THE COMMAND SYSTEMS TASK SEEKS TO DEVELOP RESEARCH INFORMATION BY WHICH THE EFFECTIVENESS OF CURRENT AND FUTURE COMMAND INFORMATION PROCESSING SYSTEMS MAY BE MAXIMIZED, PURSUING ITS OBJECTIVE THROUGH INTENSIVE EXPERIMENTATION IN SPECIFIC ARMY MAN-MACHINE COMPLEXES. THE PRESENT PUBLICATION DESCRIBES THE SCOPE, RATIONALE, AND ORGANIZATION OF A RESEARCH PROGRAM TO PROVIDE THAT INFORMATION TO DESIGNERS, DEVELOPERS, AND USERS. THE PROGRAM REPRESENTS A COMPREHENSIVE APPROACH TO RESEARCH CONCERNED WITH AUTOMATED COMMAND INFORMATION PROCESSING SYSTEMS, RANGING FROM DETAILED STUDIES OF DISCRETE HUMAN FUNCTIONS TO INTEGRATION OF SIZABLE HIGHLY AUTOMATED COMPUTERIZED SYSTEMS. TASK EFFORT FOR THE PRESENT AND IN THE IMMEDIATE FUTURE WILL BE CONCENTRATED ON STUDIES DEALING WITH INFORMATION ASSIMILATION AND DECISION MAKING. THE REPORT DELINEATES A SERIES OF STUDIES IN PROGRESS OR PROJECTED ON NINE MAJOR ASPECTS OF THESE FUNCTIONS: (1) AMOUNT AND DENSITY OF INFORMATION; (2) SPECIFICITY OF INFORMATION; (3) ALPHA-NUMERIC AND SYMBOLIC PRESENTATION; (4) TYPE, EXTENT, AND RATE OF INFORMATION UPDATING; (5) CODING OF UPDATED INFORMATION AND HARD COPY; (6) SEQUENCE OF INFORMATION PRESENTATION; (7) INDIVIDUAL AND GROUP WORK METHODS AND DISPLAYS; (8) VISUAL AND AUDITORY DISPLAYS; (9) COMPUTER-AIDED PERFORMANCE. RESEARCH TO BE ACCOMPLISHED IN REMAINING SUBTASKS CONCERNED WITH PROBLEMS IN THE INFORMATION PREPARATION AND SYSTEM INTEGRATION AREAS IS MORE GENERALLY DISCUSSED. (A)

A SELECTED BIBLIOGRAPHY OF 31 ADDITIONAL PUBLICATIONS ON COMMAND SYSTEMS RESEARCH IS APPENDED.

40P, 31R.

COMMENTS:

THIS PAPER OUTLINES A PROPOSED LONG-TERM (10-YEAR) RESEARCH PROGRAM. NO RESULTS ARE PRESENTED. IT MAY BE USEFUL FOR RESEARCH IDEAS AND FOR ITS BIBLIOGRAPHY OF EARLY COMMAND SYSTEMS RESEARCH PUBLICATIONS.

COMMAND AND CONTROL SYSTEMS

RINGEL, S., BAKER, J.D., STRUB, M.H., & KENSINGER, L.L. HUMAN FACTORS RESEARCH IN COMMAND INFORMATION PROCESSING SYSTEMS: SUMMARY OF RECENT STUDIES (TECHNICAL REPORT 1158). ARLINGTON, VIRGINIA: ARMY BEHAVIORAL SCIENCE RESEARCH LABORATORY, JULY 1969. (NTIS NO. AD 694347) DESCRIPTION:

THIS PAPER SUMMARIZES RESEARCH CONDUCTED AT THE ARMY BEHAVIORAL RESEARCH LABORATORY ON TACTICAL INFORMATION PROCESSING AND TACTICAL OPERATIONS SYSTEMS. THIS RESEARCH IS DIRECTED TOWARD ENHANCING HUMAN PERFORMANCE AND FACILITATING MAN-MACHINE INTERACTION. THE FINDINGS HAVE IMPLICATIONS FOR SYSTEMS DESIGN, DEVELOPMENT, AND OPERATIONAL USE. 24P, 24R.

COMMENTS:

THIS IS A VERY BROAD OVERVIEW, WITH NO DETAILED RESEARCH RESULTS. PRESENTS A FEW CONCLUSIONS, PRIMARILY WITH RESPECT TO TACTICAL INFORMATION SYSTEMS, AND PROVIDES REFERENCES TO THE INDIVIDUAL RESEARCH REPORTS.

RESEARCH ON COMMAND AND CONTROL SYSTEMS 411

RINGEL, S., VICINO, F.L., & ANDREWS, R.S. HUMAN FACTORS RESEARCH IN COMMAND INFORMATION PROCESSING SYSTEMS (TECHNICAL REPORT 1145). WASHINGTON, D.C.: ARMY PERSONNEL RESEARCH OFFICE, MARCH 1966. (NTIS NO. AD 634313) DESCRIPTION:

THIS REPORT DESCRIBES THE SCOPE, RATIONALE, ORGANIZATION, AND PROGRESS OF A COMMAND SYSTEMS RESEARCH PROGRAM TO PROVIDE HUMAN FACTORS INFORMATION NEEDED FOR PERFORMANCE WITHIN COMPLEX AUTOMATED INFORMATION PROCESSING FOLLOWING A SURVEY OF MILITARY INFORMATION PROCESSING SYSTEMS. EQUIPMENT AND OPERATIONS AND FUTURE PLANS FOR COMMAND INFORMATION PROCESSING SYSTEMS, BASIC HUMAN FACTORS PROBLEMS WERE IDENTIFIED AND ORGANIZED ARGUND FIVE CRITICAL OPERATIONS -- SCREENING INCOMING DATA, TRANSFORMING RAW DATA FOR INPUT INTO STORAGE DEVICES, INPUT, ASSIMILATION OF DISPLAYED INFORMATION AND DECISION MAKING. A RESEARCH PROGRAM WAS FORMULATED AND STUDIES UNDERTAKEN TO YIELD EMPIRICAL INFORMATION ABOUT THE EFFECTS ON HUMAN PERFORMANCE OF (1) CHARACTERISTICS OF THE INFORMATION PRESENTED (DENSITY, AMOUNT, ETC.), (2) DYNAMIC ASPECTS OF INFORMATION (TYPE, EXTENT, CODING OF UPDATES), (3) DISPLAY MODES AND SENSORY MODALITIES (GROUP VS INDIVIDUAL DISPLAYS, MULTISENSORY DISPLAYS), AND (4) COMPUTER AIDS TO THE DECISION PROCESS. A COMMAND SYSTEMS LABORATORY WAS DEVELOPED TO PERMIT

PROCESS. A CUMMAND STREMS LABORATORY WAS DEVELORED.

SIMULATION OF VARIOUS TOS FUNCTIONS.

FINDINGS HAVE SUGGESTED THE POSSIBILITY OF REDUCTION IN STORAGE
CAPACITY REQUIREMENTS, NUMBER OF DISPLAYS CALLED FROM STORAGE DURING A
GIVEN OPERATIONAL TIME PERIOD, AND TIME REQUIRED FOR THE TOTAL INFORMATION
ASSIMILATION PROCESS AND SUPPORTED THE INCORPORATION AND USE OF INFORMATION
ASSIMILATION CAPACITY CONTRACTORY CONTRACTORY

CONTRACTORY CONTRACTORY CAPACITY TO COMMAND SYSTEMS. (A) CONSPICUITY CODING CAPABILITIES IN COMMAND SYSTEMS. (A) 29P, 9R.

COMMENTS:

THIS PAPER DESCRIBES THE PHYSICAL LAYOUT OF THE COMMAND SYSTEMS LABORATORY AND BRIEFLY REVIEWS SEVEN EXPERIMENTS CONDUCTED THERE. THESE EXPERIMENTS ARE CONCERNED WITH INFORMATION ASSIMILATION AND DECISION MAKING. ALTHOUGH THE RESULTS OF THESE EXPERIMENTS ARE CLEARLY REPORTED, THE EXPERIMENTAL PROCEDURES USED ARE NOT DESCRIBED IN SUFFICIENT DETAIL TO ALLOW A MEANINGFUL EVALUATION OF THESE RESULTS. THIS PAPER WOULD PROVIDE A GOOD INTRODUCTION TO RESEARCH IN INFORMATION ASSIMILATION AND DECISION MAKING IN A TACTICAL OPERATIONS SYSTEM ENVIRONMENT. THE READER WHO WISH THE READER WHO WISHES MORE DETAILED DESCRIPTIONS OF THIS RESEARCH IS REFERRED TO THE FOLLOWING: ANDREWS, R.S., AND RINGEL, S. (1969)

ANDREWS, R.S., VICINO, F.L., AND RINGEL, S. (1964) HAMMER, C.H., AND RINGEL, S. (1964) HAMMER, C.H., AND RINGEL, S. (1965) RINGEL, S. (1963)

RINGEL, S. AND HAMMER, C.H. (1964)

VICINO, F.L. (1962)

VICINO, F.L., ANDREWS, R.S., AND RINGEL, S. (1965)

412 GRAPHICAL INPUT DEVICES
RITCHIE, G.J., & TURNER, J.A. INPUT DEVICES FOR INTERACTIVE GRAPHICS.
INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1975, 7, 639-66G.
DESCRIPTION:

INTERACTIVE GRAPHIC SYSTEMS PROVIDE THE POTENTIAL FOR NATURAL AND EFFICIENT MAN-MACHINE COMMUNICATION. IN ORDER TO EXPLOIT FULLY THIS POTENTIAL AND PROVIDE A CONCEPTUALLY SIMPLE MAN-COMPUTER INTERFACE, THE GRAPHIC INPUT AND OUTPUT DEVICES MUST BE CLOSELY INTEGRATED. THIS PAPER CLASSIFIES AND SURVEYS THE BASIC PERIPHERAL HARDWARE, IN PARTICULAR THAT RELEVANT TO GRAPHIC DATA ENTRY, AND RELATES THE MERITS OF EACH DEVICE TO THE INTERACTION PROCESS. (A)

COMMENTS:

THIS IS A DESCRIPTIVE REVIEW OF THE HARDWARE TECHNIQUES EMPLOYED IN A VARIETY OF TYPES OF GRAPHICAL INPUT DEVICES, INCLUDING JOYSTICKS, TRACK BALLS, THE MOUSE, LIGHTPENS, AND A NUMBER OF DATA ENTRY TABLETS AND TOUCH-ENTRY DEVICES. THE REVIEW IS NEITHER CRITICAL NOR PARTICULARLY INTEGRATIVE. IT CONTAINS SOME QUANTITATIVE INFORMATION WHICH MAY BE USEFUL IN DEVICE SELECTION (E.G., RESOLUTIONS ACHIEVABLE VIA VARIOUS APPROACHES TO DATA TABLETS). ITS GREATER VALUE MAY BE THAT IT PROVIDES TO THE NON-HARDWARE-ORIENTED SYSTEM DESIGNER AN INTRODUCTION TO THE BASIC FUNCTIONAL CAPABILITIES AND LIMITATIONS OF THE VARIOUS HARDWARE DEVICES AVAILABLE TO HIM. CONSIDERED FROM THIS VIEWPOINT, THOUGH, THE PAPER MAY BE SOMEWHAT DISAPPOINTING, AS ITS HARDWARE ORIENTATION SOMETIMES MAKES IT DIFFICULT TO RELATE THOSE CAPABILITIES AND LIMITATIONS TO THE USER-PERCEPTIBLE PROPERTIES OF THE DEVICES.

413 CORRELATES OF COMMAND-AND-CONTROL DECISION QUALITY
ROBINS, J.E., BUFFARDI, L., & RYAN, T.G. RESEARCH ON TACTICAL MILITARY
DECISION MAKING: APPLICATION OF A DECISION PREDICTION CONCEPT IN A SIMTOS
ENVIRONMENT (TECHNICAL PAPER 246). ARLINGTON, VIRGINIA: U.S. ARMY RESEARCH
INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES, MARCH 1974. (NTIS NO.
AD 780812)
DESCRIPTION:

THE PRESENT EXPERIMENT WAS CONDUCTED TO DETERMINE WHETHER PREDICTORS OF DECISION QUALITY ESTABLISHED IN A PRIOR EXPERIMENT -- BASED ON ACADEMIC ACHIEVEMENT AND INFORMATION PROCESSING STRATEGY -- MAINTAINED THEIR EFFECTIVENESS IN A DEFENSIVE PLANNING SCENARIO INCORPORATING A FULLY COMPUTERIZED INFORMATION RETRIEVAL CAPABILITY. A TEST SCENARIO FOR DEFENSIVE PLANNING WAS DEVELOPED AND ADMINISTERED INDIVIDUALLY TO 20 SENIOR FIELD GRADE OFFICERS, FOUR AT A TIME. ACCESS TO DATA BASE AND PRESENTATION OF STIMULUS MATERIAL WERE FULLY AUTOMATED. EACH OFFICER, ASSUMING THE ROLE OF A G3 OPERATIONS OFFICER, PLANNED A DIVISION DEFENSE, IN SECTOR, AGAINST AN EXPECTED ATTACK BY TWO MECHANIZED INFANTRY AGGRESSOR DIVISIONS. DECISION QUALITY WAS SCORED ACCORDING TO STANDARDS DEVELOPED BY THE USCGCS AT FORT LEAVENWORTH. NINE PREDICTORS SELECTED IN A PRIOR EXPERIMENT WERE INCLUDED IN THE PRESENT ANALYSIS. THERE WERE BASED ON AN INDIVIDUAL'S CAREER EXPERIENCE, HIS ACADEMIC RECORDS IN STAFF COLLEGE, THE INFORMATION PROCESSING AND ASSIMILATION STRATEGY HE USES, AND NUMBER OF RELEVANT FACTS OBTAINED IN PROCESSING TACTICAL INFORMATION.

FOUR PREDICTORS MAINTAINED SUBSTANTIAL PREDICTIVE STABILITY IN THE PRESENT SIMTOS ENVIRONMENT (YIELDING A MULTIPLE CORRELATION COEFFICIENT OF .79 WHICH REDUCED TO .59 WHERE CORRECTED FOR SHRINKAGE): (1) RECENCY AT CGCS; (2) CGCS CLASS STANDING; (3) INFORMATION REQUEST SLOPE, THE NUMBER OF INFORMATION REQUESTS MADE BY THE OFFICER EARLY IN THE DECISION—MAKING PROCESS IN RELATION TO DECISION QUALITY; AND (4) TERMINAL PAUSE, THE TIME BETWEEN FINAL INFORMATION REQUEST AND DECISION. PREDICTORS DEMONSTRATED THEIR EFFECTIVENESS IN A STATIC TACTICAL PLANNING SITUATION. FINAL DETERMINATION OF THE UTILITY OF THE PREDICTOR CONCEPT AWAITS ITS APPLICATION IN A SIMULATED COMBAT ENVIRONMENT. (A)

61P, 2R. COMMENTS:

THE AUTHORS OF THIS PAPER TAKE A RATHER UNIQUE APPROACH TO IMPROVING MAN-COMPUTER PROBLEM-SOLVING ABILITIES IN COMMAND AND CONTROL SITUATIONS. WHILE MOST RESEARCH IN THIS AREA IS CONCERNED WITH PROVIDING COMPUTER AIDS FOR THE HUMAN PROBLEM SOLVER, THIS PAPER FOCUSES ON IMPROVING THE HUMAN SIDE OF THE MAN-COMPUTER INTERFACE. THE EXPERIMENT REPORTED IN THIS PAPER USED HIGHLY EXPERIENCED SUBJECTS AND INDICATED FOUR FACTORS THAT COULD BE USED TO INDICATE SUCCESSFUL PERFORMANCE IN TACTICAL SITUATIONS. TWO OF THESE FACTORS FOCUS ON TRAINING AT THE ARMY COMMAND AND GENERAL STAFF COLLEGE (CGSC); HIGH LOADINGS ON THESE FACTORS IS NOT SURFRISING SINCE PERFORMANCE WAS JUDGED IN ACCORDANCE WITH CGSC STANDARDS. THE REMAINING TWO FACTORS ARE CONCERNED WITH INFORMATION REQUEST CHARACTERISTICS. ALTHOUGH THESE ARE POTENTIALLY IMPORTANT PREDICTORS, THIS PAPER DOES NOT CONSIDER THE QUALITY OF THE INFORMATION THAT IS AVAILABLE OR THE MANNER IN WHICH IT IS PRESENTED. THE CONCEPTS AND METHODS DESCRIBED IN THIS PAPER WOULD BE OF INTEREST TO THOSE CONCERNED WITH PERSONNEL SELECTION AND THIS PAPER MAY BE OF INTEREST TO THOSE CONCERNED WITH COMMAND AND CONTROL.

414 USER PERFORMANCE, STATISTICAL SUMMARY
RODRIGUEZ, H., JR. MEASURING USER CHARACTERISTICS ON THE MULTICS SYSTEM
(TECHNICAL REPORT NO. MIT/LCS/TM-B9). CAMBRIDGE, MASSACHUSETTS: MASSACHUETTS
INSTITUTE OF TECHNOLOGY, AUGUST 1977.
DESCRIPTION:

ONE OF THE PROBLEMS IN MEASURING THE PERFORMANCE OF A COMPUTER SYSTEM IS IN DEFINING ITS NORMAL WORKLOAD. IN THE CASE OF TIMESHARING SYSTEMS, IT IS NECESSARY TO DEVELOP A BEHAVIORAL MODEL OF THE AVERAGE USER. THIS THESIS PRESENTS A STUDY OF SEVERAL PARAMETERS THAT CHARACTERIZE USER BEHAVIOR ON THE MULTICS TIMESHARING SYSTEM AT MIT. DATA WAS GATHERED BY MONITORING THE LOGON SESSIONS OF THREE DIFFERENT GROUPS OF USERS. THE RESULTS ARE PRESENTED AND COMPARISONS ARE MADE BETWEEN THE COMMAND USAGE OF THE GROUPS. SOME PATTERNS OF USAGE DO APPEAR IN THE RESULTS, BUT IT IS UNCLEAR IF THEY CAN BE APPLIED IN OTHER SITUATIONS.

A PROBABILITY DISTRIBUTION OF THE THINK TIME BETWEEN COMMANDS IS SHOWN AND COMPARED WITH OTHER DISTRIBUTIONS. THE BENCHMARK PROGRAM CURRENTLY USED ON THE MULTICS SYSTEM IS ALSO COMPARED WITH THE USER MODEL DESCRIBED IN THIS STUDY. THE CAPABILITY TO MONITOR USER BEHAVIOR AND CHARACTERISTICS IS SHOWN TO BE USEFUL AND WORTH INSTALLING IN THE SYSTEM. (A) 52P, 6R.

COMMENTS:

THIS PAPER PRESENTS A LARGE NUMBER OF STATISTICAL SUMMARIES DESCRIBING USER CHARACTERISTICS OF THE MULTICS SYSTEM. SINCE MULTICS IS A SPECIALIZED SYSTEM, IT IS LIKELY THAT THE RESULTS REPORTED ARE NOT DIRECTLY APPLICABLE TO OTHER TIME-SHARING SYSTEMS. A SECOND LIMITATION OF THIS PAPER IS THE LACK OF STATISTICAL COMPARISONS. FOR EXAMPLE, THE THREE GROUPS OF SUBJECTS USED DIFFERED ALONG. SEVERAL DIMENSIONS, INCLUDING EXPERIENCE, AND THEY APPEAR TO DIFFER IN SEVERAL OF THE REPORTED MEASURES. THESE DIFFERENCES, HOWEVER, ARE NOT ANALYZED.

415 COMPUTER AIDS FOR MEDICAL DIAGNOSIS
ROGERS, C.A., BALINTFY, J.L., & GOLDMAN, A.M. COMPUTERS, PHYSICIANS, AND THE
DIAGNOSTIC DECISION-MAKING PROCESS. HUMAN FACTORS, 1964, 6, 459-464.
DESCRIPTION:

UTILIZING COMPUTER GAMING TECHNIQUES, A PILOT EXPERIMENT WAS CONDUCTED WHICH LOCATED SEVERAL POSSIBLE PARAMETERS RELATING TO DEGREE OF DIFFICULTY OF DIAGNOSIS IN INTERNAL MEDICINE; PRIVATE PHYSICIANS SERVED AS SUBJECTS AND THE FIELD OF INQUIRY WAS LIMITED TO FUNCTIONAL AND ORGANIC DISEASES OF THE RESPIRATORY SYSTEM. A SECOND STUDY WAS THEN CONDUCTED IN WHICH A DIGITAL COMPUTER SERVED THE FUNCTION OF PROVIDING OBJECTIVE FEEDBACK TO THE M.D. DURING DIAGNOSIS, INDICATING NUMBER AND NAMES OF DISEASES CONSISTENT WITH EACH ACQUISITION OF NEW INFORMATION ABOUT THE PATIENT. PERFORMANCE OF THE SUBJECTS UNDER THE LATTER CONDITION INDICATED SIGNIFICANT BEHAVIORAL CHANGES WHEN COMPARED WITH THE PREVIOUS STUDY. FINDINGS ARE INTERPRETED IN TERMS OF THE MAN-MACHINE RELATIONSHIP AND ITS IMPORTANCE TO ON-LINE COMPUTER APPLICATIONS OF A DIAGNOSTIC NATURE. (A)

COMMENTS:

CERTAIN ASPECTS OF THIS PAPER ARE SERIOUSLY DATED IN THAT MUCH MORE SOPHISTICATED DIAGNOSTIC DECISION AIDS FOR PHYSICIANS HAVE BEEN DEVELOPED SINCE IT WAS WRITTEN. IT DOES, HOWEVER, MAKE SOME INTERESTING AND WORTHWHILE POINTS. THE FIRST IS THAT PHYSICIANS ARE WILLING TO USE SUCH AIDS EVEN THOUGH THEY MAY REQUIRE SOME CHANGES IN A PHYSICIAN'S NORMAL PATTERN OF BEHAVIOR. A SECOND POINT IS RELATED TO HUMAN PROBLEM-SOLVING ABILITIES IN GENERAL. IN MAKING A DIAGNOSIS, A PHYSICIAN RELIES HEAVILY ON POSITIVE (OR ABNORMAL) SYMPTOMS OR FINDINGS AND TENDS TO IGNORE NEGATIVE FINDINGS, EVEN THOUGH NEGATIVE FINDINGS ALSO INDICATE THE PRESENCE OR ABSENCE OF A POSSIBLE DISEASE. SUCH BEHAVIOR MAY WELL BE GENERAL TO HUMAN PROBLEM-SOLVING BEHAVIOR AND SUGGESTS THAT COMPUTER AIDS SHOULD BE DESIGNED TO AID THE PROBLEM SOLVER IN USING BOTH POSITIVE AND NEGATIVE INFORMATION.

DATA ENTRY

ROOT, R.T., & SADACCA, R. MAN-COMPUTER COMMUNICATION TECHNIQUES: TWO EXPERIMENTS. HUMAN FACTORS, 1967, 9, 521-528.

DESCRIPTION:

TWO EXPERIMENTAL STUDIES ARE REPORTED THAT WERE INTENDED TO EVALUATE ALTERNATIVE MAN-COMPUTER COMMUNICATION TECHNIQUES WITHIN THE CONTEXT OF A COMPUTER-BASED IMAGE INTERPRETATION FACILITY. THE FIRST EXPERIMENT, COMPARING FIVE DIFFERENT DATA ENTRY PROCEDURES, INDICATED THAT, ALTHOUGH A PROCEDURE REQUIRING THE INTERPRETER TO ENTER DATA DIRECTLY USING A TELETYPE KEYBOARD RESULTED IN THE SHORTEST OVERALL THROUGHPUT TIME, A PROCEDURE INVOLVING MESSAGE COMPOSITION BY THE IMAGE INTERPRETER WITH SUBSEQUENT TRANSCIPTION BY A COMMUNICATOR MINIMIZES THE TIME SPENT BY THE INTERPRETER IN REPORT GENERATION AND MAXIMIZES THE TIME AVAILABLE FOR THE DETECTION AND IDENTIFICATION OF TARGETS ON AERIAL IMAGERY. THE SECOND EXPERIMENT EVALUATING ALTERNATIVE WORD FORM-DATA ENTRY FORMAT COMBINATIONS, SHOWED NO DIFFERENCES AMONG THE SIX CONDITIONS STUDIED. (A) 8P, 1R.

COMMENTS:

THE EXPERIMENTS DESCRIBED IN THIS PAPER APPEAR TO HAVE BEEN CAREFULLY CONTROLLED AND ARE CLEARLY REPORTED. THESE EXPERIMENTS WERE CONDUCTED IN RESPONSE TO THE DEVELOPMENT OF INTERACTIVE SYSTEMS THAT ALLOWED OPERATORS TO COMMUNICATE DIRECTLY, RATHER THAN INDIRECTLY, WITH THE COMPUTER. ALTHOUGH SPECIFICALLY CONCERNED WITH ARMY COMMUNICATIONS CENTER OPERATIONS, THE RESULTS OF THESE EXPERIMENTS SHOULD APPLY TO A VARIETY OF INTERACTIVE DATA ENTRY SITUATIONS. THESE RESULTS ALSO INDICATE A SPEED-ACCURACY TRADE-OFF BETWEEN VARIOUS DATA ENTRY PROCEDURES, WHICH, PERHAPS DUE TO THE SPECIFIC PROCEDURES EMPLOYED, IS SMALLER THAN MIGHT BE EXPECTED. THIS PAPER CONTAINS SEVERAL USEFUL IDEAS FOR DATA ENTRY PROCEDURES.

GENERAL DISCUSSION OF MAN-COMPUTER INTERACTION ROUSE, W.B. DESIGN OF MAN-COMPUTER INTERFACES FOR ON-LINE INTERACTIVE SYSTEMS. PROCEEDINGS OF THE IEEE, 1975, 63, 847-857. DESCRIPTION:

AN ATTEMPT IS MADE TO INTEGRATE A WIDE RANGE OF MATERIAL INTO A CONCEPTUAL STRUCTURE FOR THE DESIGN OF MAN-COMPUTER INTERFACES FOR ON-LINE SYSTEMS. TYPICAL ROLES FOR THE HUMAN IN MAN-COMPUTER SYSTEMS ARE CONSIDERED. SUGGESTIONS FOR THE DESIGN OF SYSTEMS ARE DEVELOPED IN DISCUSSIONS OF OF DISPLAYS AND INPUT DEVICES, VISUAL INFORMATION PROCESSING, AND MATHEMATICAL MODELS OF HUMAN BEHAVIOR. POSSIBLE DEVELOPMENTS AND AVENUES OF RESEARCH IN MAN-COMPUTER SYSTEMS ARE SUGGESTED. (A) 175R.

COMMENTS:

THIS PAPER CONTAINS A FAIRLY EXTEMSIVE REVIEW OF THE LITERATURE ON MAN-COMPUTER INTERACTION. ALTHOUGH THIS PAPER IS TOO BRIEF TO SUCCESSFULLY INTEGRATE THIS LITERATURE OR PRESENT GUIDELINES FOR SYSTEM DESIGN, IT COULD BE USEFUL AS AN INTRODUCTION TO MAN-COMPUTER INTERACTION AND RELATED TOPICS. THIS PAPER ALSO INCLUDES A FAIRLY LARGE BIBLIOGRAPHY THAT WOULD BE USEFUL TO THOSE WISHING TO FOLLOW UP ANY OF THE TOPICS COVERED IN THIS PAPER.

418 DECISION AIDING

ROUSE, W.B., & GREENSTEIN, J.S. A MODEL OF HUMAN DECISION MAKING IN MULTI-TASK SITUATIONS: IMPLICATIONS FOR COMPUTER AIDING. IN PROCEEDINGS, IEEE INTERNATIONAL CONFERENCE ON CYBERNETICS AND SOCIETY, NOVEMBER 1976. NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC., 1976, 425-433. DESCRIPTION:

MULTI-TASK DECISION MAKING IS DISCUSSED IN TERMS OF EVENT DETECTION AND ACTION SELECTION. MODELS OF HUMAN PERFORMANCE IN THESE TASKS ARE PROPOSED AND TWO EXPERIMENTS ARE DISCUSSED. PRELIMINARY RESULTS ARE PRESENTED AND THE IMPLICATIONS FOR COMPUTER AIDING ARE CONSIDERED. (A) 9P, 21R.

COMMENTS:

THIS PAPER IS CONCERNED WITH TASKS IN WHICH A DECISION MAKER MUST MONITOR SEVERAL EVENTS, DETERMINE WHEN AN EVENT REQUIRES THAT SOME ACTION BE TAKEN, AND SELECT AN APPROPRIATE ACTION. EXAMPLES OF SUCH TASKS INCLUDE AIR TRAFFIC CONTROL, PROCESS CONTROL, AND TACTICAL OPERATIONS. THE INTENT OF THIS RESEARCH IS TO DEVELOP MATHEMATICAL MODELS OF THE PROBLEM SOLVING PROCESSES INVOLVED IN THESE TASKS, WITH PARAMETERS THAT REFLECT INDIVIDUAL DIFFERENCES, AND THEN CONSTRUCT ADAPTIVE DECISION AIDS. THIS APPROACH IS SIMILAR TO THAT TAKEN BY A. FREEDY AND HIS COLLEAGUES IN DEVELOPING ADDAM (ADAPTIVE DYNAMIC DECISION AIDING MECHANISM). THE PROPOSED MODELS ARE FAIRLY COMPLEX AND POTENTIALLY VERY GENERAL. THE REPORTED EMPIRICAL RESULTS, HOWEVER, ARE NOT SUFFICIENT TO VALIDATE THESE MODELS.

419 BIBLIOGRAPHIC SEARCH DIALOGUES

RUBINOFF, M., BERGMAN, S., FRANKS, W., & RUBINOFF, E.R. EXPERIMENTAL EVALUATION OF INFORMATION RETRIEVAL THROUGH A TELETYPEWRITER. COMMUNICATIONS OF THE ACM, 1968, 11, 598-604.
DESCRIPTION:

EXPERIMENTS DESIGNED TO EVALUATE THE CAPABILITIES OF MECHANIZED INFORMATION RETRIEVAL SYSTEMS, WITH EMPHASIS ON INTERACTIVE (MAN-MACHINE) LANGUAGE AND ON SOME OF THE MECHANICAL AND PSYCHOLOGICAL LIMITATIONS ON THEIR DESIGN, WERE CONDUCTED AT THE MOORE SCHOOL INFORMATION SYSTEMS LABORATORY. THE BASIC ASSUMPTION OF THE RESEARCH IS THAT AN INFORMATION RETRIEVAL SYSTEM THAT PROVIDES FOR MAN-MACHINE DIALOGUE AT A REMOTE INQUIRY TERMINAL SHOULD PROVIDE A SEARCHER WITH MANY OF THE TOOLS WHICH WOULD BE AVAILABLE TO HIM WERE HE ACTUALLY PERFORMING HIS SEARCH AT A LIBRARY OR REPOSITORY OF DOCUMENTS. FACTORS INVOLVED IN EVALUATION OF SUCH A SYSTEM INCLUDE EASE OF USE, LEARNING TIME, AND EFFECTIVENESS OF ACTUAL RETRIEVAL. THREE EXPERIMENTS AND THE CONCLUSIONS RESULTING FROM THEM ARE DETAILED. (A)

COMMENTS:

IN A LIBRARY OR WITH A BATCH INFORMATION RETRIEVAL SYSTEM THERE IS GENERALLY AN INFORMATION SPECIALIST WHO QUESTIONS THE USER ABOUT HIS NEEDS AND FORMULATES THE APPROPRIATE QUERY. IN AN INTERACTIVE SYSTEM, HOWEVER, THE USER IS RESPONSIBLE FOR DEFINING THE APPROPRIATE QUERY. ALTHOUGH THE SYSTEM DESCRIBED IN THIS PAPER DOES NOT INCLUDE AIDS TO HELP THE USER WITH THIS TASK, IT COULD BE USED TO INCORPORATE SUCH FEATURES AS THE TUTORIAL AIDS DESCRIBED BY D.E. CARUSO (1970) OR THE SEARCH STRATEGY TECHNIQUES DESCRIBED BY D.U. WILDE (1969). THE EXPERIMENTS DISCUSSED IN THE PRESENT PAPER ARE MENTIONED ONLY BRIEFLY AND THE RESULTS APPEAR TO BE SPECIFIC TO THESE PARTICULAR EXPERIMENTS. ALTHOUGH THE CONCEPTS PRESENTED HERE HAVE NOT BEEN TESTED, THEY MAY PROVIDE USEFUL IDEAS FOR THOSE INTERESTED IN INFORMATION RETRIEVAL SYSTEMS.

420 COMPARISONS OF TIME-SHARING WITH BATCH PROCESSING
SACKMAN, H. TIME-SHARING VERSUS BATCH PROCESSING: THE EXPERIMENTAL EVIDENCE.
AFIPS CONFERENCE PROCEEDINGS, 1968, 32, 1-10 (ALSO PUBLISHED WITH ADDITIONAL
SUMMARY SECTION AS TECHNICAL REPORT SP2975, SYSTEM DEVELOPMENT CORP., SANTA
MONICA, CALIFORNIA, OCTOBER 1967, NTIS NO. AD 661665).
DESCRIPTION:

THE CONTINUING CONTROVERSY OVER THE RELATIVE MERITS OF TIME-SHARING VERSUS BATCH PROCESSING HAS TAKEN A NEW AND SIGNIFICANT TURN FROM PREDISCIPLINARY SPECULATION TO APPLIED SCIENTIFIC EXPERIMENTATION. WITHIN THE LAST TWO YEARS, FIVE EXPERIMENTAL STUDIES HAVE APPEARED IN THE LITERATURE, EACH COMPARING SOME FORM OF ONLINE AND OFFLINE DATA PROCESSING WITH RESPECT TO MAN-MACHINE MEASURES OF SYSTEM PERFORMANCE. THESE FIVE PIONEERING STUDIES COMPRISE THE FIRST SUBSTANTIVE DATA BASE FOR COMPARING AND EVALUATING EXPERIMENTAL METHODOLOGY AND FINDINGS BEARING ON THE GROWING AND CHANGING COMPETITION BETWEEN TIME-SHARING AND BATCH PROCESSING SYSTEMS. THIS PAPER PROVIDES A CRITICAL REVIEW OF THESE FIVE EXPERIMENTS, SUMMARIZES FINDINGS, PROBLEMS AND PITFALLS, AND OFFERS RECOMMENDATIONS FOR FUTURE EXPERIMENTAL WORK. (A)

FIVE EXPERIMENTAL COMPARISONS OF TIME-SHARING AND BATCH SYSTEMS ARE REVIEWED. THE COMPOSITE RESULTS INDICATE THAT TIME-SHARING REQUIRES FEWER MAN-HOURS, POSSIBLY PRODUCES HIGHER QUALITY RESULTS, AND IS PREFERRED BY USERS. BATCH PROCESSING MAY REQUIRE LESS COMPUTER TIME AND INVOLVE LOWER COSTS. THE METHODOLOGICAL ISSUES OF SUCH COMPARISONS ARE DISCUSSED AND SUGGESTIONS ARE MADE FOR ADDITIONAL EXPERIMENTS.

### COMMENTS:

THIS PAPER IS A GOOD REVIEW OF THE RESULTS AND, ESPECIALLY, THE METHODOLOGY OF STUDIES BY ERIKSON (1966), GOLD (1967), GRANT AND SACKMAN (1967), SCHATZOFF, TSAO, AND WIIG (1967), AND SMITH (1967), BUT THE PAPER IS LARGELY SUPERSEDED BY THE AUTHOR'S LATER AND MORE COMPREHENSIVE BOOK, "MAN-COMPUTER PROBLEM SOLVING."

421 USER PERFORMANCE IN TIME-SHARING AND BATCH SYSTEMS
SACKMAN, H. EXPERIMENTAL ANALYSIS OF MAN-COMPUTER PROBLEM-SOLVING. HUMAN
FACTORS, 1970, 12, 187-201.

DESCRIPTION:

EXPERIMENTAL METHODS AND FINDINGS IN HUMAN PROBLEM-SOLVING USING ON-LINE AND OFF-LINE COMPUTER SYSTEMS ARE REVIEWED. THE ADVENT OF TIME-SHARING SYSTEMS IN THE LAST DECADE PRODUCED AN INITIAL BODY OF EMPIRICAL DATA FROM USER STATISTICS AND EXPERIMENTAL STUDIES COMPARING TIME-SHARING WITH BATCH-PROCESSING. THIS BODY OF DATA IS REVIEWED FOR ITS IMPLICATIONS TO THE CONTROVERSY OVER BATCH AND TIME-SHARING SYSTEMS AND TO THE UNDERSTANDING OF HUMAN BEHAVIOR IN THE MAN-COMPUTER SETTING. A PLEA IS MADE FOR INTERDISCIPLINARY CROSS-FERTILIZATION BETWEEN BEHAVIORAL AND COMPUTER SCIENCES TO BRIDGE THE HUMANISTIC LAG IN MAN-COMPUTER COMMUNICATION. (A)

## COMMENTS:

THIS PAPER BRIEFLY REVIEWS SEVERAL REPORTS OF TIME-SHARING USER STATISTICS, AND SUMMARIZES THEM IN TERMS OF TIMING, SYSTEM EFFECTIVENESS, AND INDIVIDUAL DIFFERENCES. SEVERAL STUDIES COMPARING PROGRAMMING IN BATCH AND TIME-SHARING MODES ARE ALSO REVIEWED, ALTHOUGH THIS PORTION OF THE REPORT IS PRESENTED MORE COMPREHENSIVELY IN THE AUTHOR'S BOOK, "MAN-COMPUTER PROBLEM SOLVING". THE PAPER IS AN EXCELLENT SOURCE OF INTRODUCTORY INFORMATION ON THE BEHAVIORAL ASPECTS OF THE USE OF TIME-SHARING IN PROGRAMMING.

422 COMPARISON OF TIME-SHARING WITH BATCH PROCESSING SACKMAN, H. MAN-COMPUTER PROBLEM SOLVING. PRINCETON, NEW JERSEY: AUERBACH, 1970.

DESCRIPTION:

THIS BOOK IS CONCERNED WITH THE GROWING EXPERIMENTAL EVIDENCE ON MANCOMPUTER PROBLEM SOLVING, PARTICULARLY IN THE COMPETITION BETWEEN TIMESHARING AND BATCH-PROCESSING COMPUTER SYSTEMS. THE BOOK IS DIVIDED INTO
FOUR PARTS. PART I ESSENTIALLY CONSISTS OF AN INTRODUCTION TO TIME-SHARING
AND BATCH-PROCESSING, THE HISTORICAL BACKGROUND OF THE SCIENTIFIC STUDY
OF THE HUMAN USE OF COMPUTERS, AND SUMMARY ACCOUNTS OF EXPLORATORY ONLINE/
OFFLINE STUDIES THAT PRECEDED THE COMPREHENSIVE STUDIES DESCRIBED IN PARTS
II AND III. THE EPILOGUE, PART IV, WAS DESIGNED TO PULL TOGETHER AND
SUMMARIZE THE VARIOUS STRANDS OF RESEARCH ON MAN-COMPUTER PROBLEM SOLVING
UNDER ONLINE AND OFFLINE CONDITIONS AS REPORTED IN THIS BOOK. SPECIAL
EMPHASIS IS PLACED ON THE INTERFACE BETWEEN THESE DNLINE/OFFLINE STUDIES AND
THE MAINSTREAM OF THE BEHAVIORAL LITERATURE ON HUMAN PROBLEM SOLVING. THE
BOOK CONCLUDES WITH A PREVIEW OF MASS COMPUTER UTILITIES, AND A PLEA FOR
COOPERATIVE INTERDISCIPLINARY RESEARCH ON EXPERIMENTAL COMMUNITY PROTOTYPES
TO MEET THE CHALLENGE OF THE PUBLIC INTEREST IN THE COMPUTER-SERVICED
SOCIETY OF THE FUTURE. (A, ABBR.)
288P, 69R.

COMMENTS:

THIS TEXT IS A COMPREHENSIVE REVIEW OF THE LITERATURE FROM THE 1960'S COMPARING TIME-SHARING AND BATCH-PROCESSING. MUCH OF THE INFORMATION PRESENTED IN THIS BOOK HAS BEEN PREVIOUSLY PRESENTED IN A BRIEFER FORM IN VARIOUS PAPERS BY THE AUTHOR, BUT THIS BOOK IS THE BEST SOURCE FOR INFORMATION COMPARING THE BEHAVIORAL ASPECTS OF TIME-SHARING AND BATCH-PROCESSING.

423 LEARNING AND PROBLEM SOLVING ON A TIME-SHARING SYSTEM SACKMAN, H. TIME-SHARING AND SELF-TUTORING: AN EXPLORATORY CASE HISTORY. HUMAN FACTORS, 1970, 12, 203-214. DESCRIPTION:

THIS STUDY IS CONCERNED WITH THE EFFECTIVENESS OF INDIVIDUAL USER PERFORMANCE FOR AN EXTENDED SELF-TUTORING TASK IN A TIME-SHARED COMPUTING FACILITY. THE INVESTIGATION IS AN EXPERIMENTAL CASE HISTORY OF ONE INDIVIDUAL (THE AUTHOR) FOLLOWING THE TINT SELF-TUTORING USER MANUAL FROM BEGINNING TO END IN THE SDC 9-32 TIME-SHARING SYSTEM AT A TELETYPE CONSOLE. (TINT IS A USER-ORIENTED DIALECT OF JOVIAL, AN INTERPRETIVE LANGUAGE ADAPTED TO TIME-SHARING WITH MANY SELF-TEACHING FEATURES.) THE METHODOLOGY FEATURED MEASUREMENT OF NATURAL USER BEHAVIOR IN WHICH THE USER SERVED AS HIS OWN CONTROL IN SUCCESSIVE CONSOLE SESSIONS. THE SAMPLE INCLUDED 1,861 USER INPUT COMMANDS COLLECTED OVER 18 HOURS AT THE

THE QUANTITATIVE RESULTS REVEALED SOME EVIDENCE FOR SYSTEMATIC LEARNING AND REINFORCEMENT EFFECTS; THERE WERE PROGRESSIVE TENDENCIES TOWARD HIGHER PRODUCTIVITY AND LOWER ERROR RATES WITH INCREASING TINT EXPERIENCE. THE QUALITATIVE FINDINGS REVEALED THAT THE NUMEROUS AND DIVERSIFIED EXERCISES FACILITATED FAMILIARITY WITH THE ELEMENTS AND THE VARIED SERVICES OF THE TINT SYSTEM. THE CHIEF DRAWBACK WAS EXCLUSIVE RELIANCE OF THE TUTORING METHOD ON LITERAL REPRODUCTION OF THE TEXT BY THE USER AT HIS CONSOLE. THE PAPER CONCLUDES WITH RECOMMENDATIONS FOR MORE GENUINE INTERACTIVE INVOLVEMENT BETWEEN THE USER, THE CENTRAL SYSTEM, AND SELF-TUTORING AIDS.

12P, BR.

THERE ARE SEVERAL POTENTIALLY SERIOUS METHODOLOGICAL LIMITATIONS INHERENT IN STUDIES THAT INVESTIGATE THE BEHAVIOR OF SINGLE SUBJECT. THE AUTHOR DOES, HOWEVER, PROVIDE AN ADEQUATE DISCUSSION OF THESE LIMITATIONS IN THE FINAL PORTION OF THIS PAPER. SINGLE-SUBJECT STUDIES MAY BE APPROPRIATE, HOWEVER, FOR INVESTIGATING NEW METHODOLOGIES AND THIS IS THE PRINCIPAL PURPOSE OF THIS PAPER. IT IS INTERESTING TO NOTE THE AUTHOR'S CONCLUSION THAT HABITS DEVELOPED IN A BATCH PROCESSING ENVIRONMENT ARE USED TO FORMULATE AND SOLVE PROBLEMS IN AN INTERACTIVE ENVIRONMENT. THIS SUGGESTS THE NEED FOR MORE CONTROLLED RESEARCH ON INTERACTIVE PROBLEM SOLVING AND PARTICULARLY ON THE TYPES OF COMPUTER AIDS THAT WOULD BE USEFUL.

424 RESEARCH ON COMPUTER-AIDED PLANNING
SACKMAN, H. ADVANCED RESEARCH IN ONLINE PLANNING. IN H. SACKMAN & R.L.
CITRENBAUM (EDS.), ONLINE PLANNING: TOWARDS CREATIVE PROBLEM-SOLVING.
ENGLEWOOD CLIFFS, NEW JERSEY: PRENTICE-HALL, 1972, 3-67.
DESCRIPTION:

THIS CHAPTER IS AN INITIAL, EXPLORATORY EFFORT CONCERNED WITH THE PROBLEM OF SELECTING A FRUITFUL LINE OF RESEARCH IN THE VIRGIN FIELD OF ONLINE PLANNING. TO HELP CAST THE PROBLEM IN PERSPECTIVE, THE STATUS OF PLANNING AND ONLINE PROBLEM SOLVING ARE REVIEWED FOR USEFUL LEADS. PLANNING IS SEEN TO BE IN AN EARLY PREDISCIPLINARY STAGE, UNDERGOING RAPID CHANGE AND REMARKABLE GROWTH. ALTHOUGH ONLINE PROBLEM SOLVING IS ALSO IN AN INCHOATE STAGE, AVAILABLE EXPERIMENTAL EVIDENCE INDICATES THAT THE ONLINE MODE IS PROBABLY BETTER SUITED FOR RELATIVELY UNSTRUCTURED, OPEN-END PROBLEMS REQUIRING MUCH EXPLORATION AND CREATIVE INSIGHT.

PLANNING THEORY IS REVIEWED AND FOUND WANTING. A PROVISIONAL DEFINITION AND A THEORY OF PLANNING ARE DEVELOPED TO MAKE PLANNING MORE AMENABLE TO SCIENTIFIC METHOD. THE CRUX OF THE PROPOSED APPROACH IS TO CONCEIVE OF PLANS AS OPERATIONALLY DEFINED HYPOTHESES SUBJECT TO EMPIRICAL TEST AND EVALUATION. BUILDING ON INDIVIDUAL AND GROUP EXPECTATION THEORY AND FINDINGS IN THE SOCIAL SCIENCE LITERATURE, A MUTUAL EXPECTATION THEORY IS SUGGESTED. THIS THEORY IS DERIVED FROM AN ANALYSIS OF CONDITIONS THAT LEAD TOWARD A WORKING CONSENSUS OF COGNIZANT INDIVIDUALS IN OBJECT PLANS.

WORKING CONSENSUS OF COGNIZANT INDIVIDUALS IN OBJECT PLANS.

A PROPOSAL FOR "PARTICIPATORY ONLINE PLANNING" IS OUTLINED, STEMMING FROM INITIAL CONSIDERATIONS OF MUTUAL EXPECTATION THEORY FOR PLANNING. IN ESSENCE, PARTICIPATORY ONLINE PLANNING REFERS TO ONLINE IMPLEMENTATION OF PROBLEM-SOLVING, TUTORIAL, AND ADVERSARY PROCESSES AMONG PLANNING ALTERNATIVES THAT CULMINATES IN CONSENSUS, PARTICULARLY AMONG DISPERSED PARTICIPATORS. THE CHAPTER CLOSES WITH AN EXTENSIVE LISTING OF ARGUMENTS FOR AND AGAINST ADVANCED RESEARCH IN PARTICIPATORY ONLINE PLANNING. (A) 65P, 72R.

COMMENTS:

THIS CHAPTER PROVIDES A VERY GOOD OVERVIEW OF PLANNING AS A HUMAN ACTIVITY AND AS A CANDIDATE FOR COMPUTER AIDING. ALTHOUGH IT INTRODUCES A COLLECTION OF PAPERS RELATED TO ONLINE PLANNING, IT IS A SELF-CONTAINED DISCUSSION WHICH SHOULD ASSIST THOSE CONSIDERING ONLINE AIDING MECHANISMS FOR PLANNING. SEVERAL VIEWPOINTS TOWARD PLANNING ARE DISCUSSED, AS ARE THE STAGES IN PLANNING. TWENTY-SIX PLANNING METHODS ARE DESCRIBED AND CATEGORIZED BY THEIR UTILITY IN VARIOUS STAGES OF THE PLANNING PROCESS AND IN THE SYSTEM DEVELOPMENT PROCESS. THE AUTHOR SUGGESTS THAT PLANNING IS PREDOMINATELY A HYPOTHESIS FORMULATION AND TEST ACTIVITY AND SHOULD BE VIEWED AS AN APPLIED SCIENCE. HE FEELS THAT THE EARLY, CREATIVE STAGES OF THE PLANNING PROCESS ARE THE BEST CANDIDATES FOR SIGNIFICANT IMPROVEMENT VIA ONLINE AIDING. THE AUTHOR HAS A VERY ECLECTIC VIEW OF PLANNING AND CONCENTRATES SOMEWHAT ON ITS SOCIAL ASPECTS IN HIS RESEARCH PROPOSAL.

425 MAN-COMPUTER PROBLEM SOLVING

SACKMAN, H. RUDIMENTS OF A REAL-WORLD THEORY OF MAN-COMPUTER PROBLEM SOLVING (TECHNICAL REPORT R-1491-NSF). SANTA MONICA, CALIFORNIA: RAND CORP., APRIL 1974. (NTIS NO. N74-30544)

DESCRIPTION:

A NINE-STAGE MODEL OF MAN-COMPUTER PROBLEM SOLVING IS PROPOSED. A SURVEY ANALYSIS OF REAL-WORLD PROBLEM SOLVING BOTH WITH AND WITHOUT COMPUTERS INDICATES: (1) THE GENERAL STAGES AND DYNAMICS OF PROBLEM SOLVING ARE SIMILAR BOTH WITH AND WITHOUT COMPUTERS, (2) THE INDIVIDUAL IS OF CENTRAL IMPORTANCE IN PROBLEM SOLVING, (3) THERE IS A WIDESPREAD DISSATISFACTION WITH INFLEXIBLE SOFTWARE AND POOR COMPUTER SOLUTIONS, AND (4) THE PROPOSED MODEL APPEARS TO BE RELIABLE AND VALID.

COMMENTS:

ONE OF THE MAJOR DEFICIENCIES IN OUR CURRENT VIEW OF MAN-COMPUTER INTERACTION IS THAT WE LACK A SOUND, VALIDATED THEORETICAL FRAMEWORK WITHIN WHICH TO DEAL WITH THE PROPERTIES OF MAN-COMPUTER PROBLEM SOLVING. THIS PAPER PRESENTS AN OUTLINE OF THE STAGES IN MAN-COMPUTER PROBLEM SOLVING WHICH MAY WELL SERVE AS A FIRST STEP TOWARD SUCH A THEORY. WHILE THIS IS ONLY A FIRST STEP, IT MAY PROVE HELPFUL NOT ONLY IN STIMULATING FURTHER THEORETICAL WORK, BUT ALSO IN STIMULATING MORE FOCUSSED ATTENTION ON THE POTENTIAL FOR COMPUTER AIDS IN SPECIFIC STAGES OF THE PROBLEM-SOLVING PROCESS. RESULTS OF THE SURVEY BRIEFLY REPORTED HERE PROVIDE SOME INSIGHTS INTO BOTH THE PROBLEM-SOLVING PROCESS AND THE WEAKNESSES OF EXISTING COMPUTER AIDS.

426 MAN-COMPUTER PROBLEM SOLVING

SACKMAN, H. DUTLOOK FOR MAN-COMPUTER SYMBIOSIS: TOWARD A GENERAL THEORY OF MAN-COMPUTER PROBLEM SOLVING. PAPER PRESENTED AT NATO ADVANCED STUDY INSTITUTE DN MAN-COMPUTER INTERACTION, MATI, GREECE, SEPTEMBER 1976.
DESCRIPTION:

IN THIS PAPER, THE GENERAL ISSUE OF MAN-COMPUTER SYMBIOSIS IS CAST WITHIN THE FRAMEWORK OF AN APPROACH TO A GENERAL THEORY OF MAN-COMPUTER PROBLEM SOLVING. ACCORDINGLY, THE MAIN TASK IS TO DEVELOP THE RUDIMENTS OF SUCH A THEORY.

THIS WORK HAS BEEN CONCERNED WITH SURVEY ANALYSES OF REAL-WORLD PROBLEM SOLVING WITH AND WITHOUT COMPUTERS PRIMARLY IN RESEARCH SETTINGS. PROMISING LEADS HAVE BEEN GLEANED, INDICATING (1) FUNDAMENTALLY SIMILAR GENERAL STAGES AND DYNAMICS OF PROBLEM SOLVING WITH AND WITHOUT COMPUTERS; (2) THE CENTRAL IMPORTANCE OF THE INDIVIDUAL FOR BSIC PROBLEM INSIGHT, EFFECTIVE USE OF COMPUTERS, AND SUCCESSFUL PROBLEM SOLUTIONS; (3) WIDESPREAD DISSATISFACTION WITH INFLEXIBLE SOFTWARE AND POOR COMPUTER SOLUTIONS; AND (4) EMPIRICAL DEMONSTRATION OF THE RELIABILITY AND VALIDITY OF A NINE-STAGE MODEL OF PROBLEM SOLVING DRAWN FROM PLANNING AND SYSTEM THEORY. THESE PROMISING RESULTS PROVIDE ENCOURAGING PROSPECTS FOR AN INTEGRATIVE THEORY OF MANCOMPUTER PROBLEM SOLVING IN THE NATURAL ENVIRONMENT OF THE USER. (4, ABBR.)

COMMENTS:

THE AUTHOR PRESENTS A BRIEF REVIEW OF LITERATURE RELEVANT TO MAN-COMPUTER PROBLEM SOLVING AND PROPOSES A THEORETICAL FRAMEWORK TO GUIDE FURTHER RESEARCH IN THIS AREA. THE AUTHOR IS QUITE CORRECT IN NOTING THAT "A SUSTAINED TRADITION OF THEORETICAL AND APPLIED EXPERIMENTAL WORK IN MAN-COMPUTER PROBLEM SOLVING DOES NOT EXIST IN COMPUTER SCIENCE, INFORMATION SCIENCE, OR BEHAVIORAL SCIENCE." A COMPREHENSIVE AND WELL-UNDERSTOOD THEORETICAL FRAMEWORK IS A NECESSARY PREREQUISITE FOR ALLEVIATING THIS PROBLEM. THE PROPOSED FRAMEWORK IS, IN GENERAL, FAIRLY GOOD AND WELL PRESENTED, BUT IT COULD BE IMPROVED BY INCORPORATING MORE RECENT WORK IN COGNITIVE PSYCHOLOGY.

427 COMPARISON OF TIME-SHARING AND BATCH PROCESSING SACKMAN, H., ERIKSON, W.J., & GRANT, E.E. EXPLORATORY EXPERIMENTAL STUDIES COMPARING ONLINE AND OFFLINE PROGRAMMING PERFORMANCE. COMMUNICATIONS OF THE ACT, 1968, 11, 3-11.

DESCRIPTION:

TWO EXPLORATORY EXPERIMENTS WERE CONDUCTED AT SYSTEM DEVELOPMENT CORPORATION TO COMPARE DEBUGGING PERFORMANCE OF PROGRAMMERS WORKING UNDER CONDITIONS OF ONLINE AND OFFLINE ACCESS TO A COMPUTER. THESE ARE THE FIRST KNOWN STUDIES THAT MEASURE PROGRAMMERS' PERFORMANCE UNDER CONTROLLED CONDITIONS FOR STANDARD TASKS.

STATISTICALLY SIGNIFICANT RESULTS OF BOTH EXPERIMENTS INDICATED FASTER DEBUGGING UNDER ONLINE CONDITIONS, BUT PERHAPS THE MOST IMPORTANT PRACTICAL FINDING INVOLVES THE STRIKING INDIVIDUAL DIFFERENCES IN PROGRAMMER PERFORMANCE. METHODOLOGICAL PROBLEMS ENCOUNTERED IN DESIGNING AND CONDUCTING THESE EXPERIMENTS ARE DESCRIBED; LIMITATIONS OF THE FINDINGS ARE POINTED OUT; HYPOTHESES ARE PRESENTED TO ACCOUNT FOR RESULTS; AND SUGGESTIONS ARE MADE FOR FURTHER RESEARCH. (A)

9P, 15R. COMMENTS:

THIS PAPER SUMMARIZES THE EXPERIMENTS REPORTED IN E.E. GRANT AND H. SACKMAN (1966) AND IN W.J. ERIKSON (1966). IT SERVES A USEFUL PURPOSE, HOWEVER, TO PRESENT THESE TWO STUDIES TOGETHER. THE PRINCIPAL DIFFERENCE BETWEEN THESE STUDIES WAS THAT GRANT AND SACKMAN USED EXPERIENCED PROGRAMMERS AND ERIKSON USED NOVICE PROGRAMMERS. THE COMBINED RESULT WAS THAT EXPERIENCED PROGRAMMERS USE LESS CPU TIME UNDER OFF-LINE CONDITIONS BUT NOVICES USE LESS UNDER ON-LINE CONDITIONS. THE EXPLANATIONS OFFERED IN THIS PAPER FOR THIS RESULT SEEM PLAUSIBLE. IT IS ALSO POSSIBLE, HOWEVER, THAT THE METHODOLOGICAL PROBLEMS ASSOCIATED WITH THESE EXPERIMENTS (WHICH ARE DISCUSSED IN CONJUNCTION WITH THE INDIVIDUAL PAPERS AND WILL NOT BE REPEATED HERE) MAY ALSO ACCOUNT FOR THIS FINDING. THIS PAPER DOES, HOWEVER, DESCRIBE THE EARLIEST ATTEMPTS AT MEASURING PROGRAMMER PERFORMANCE UNDER ON-LINE AND BATCH PROCESSING CONDITIONS AND IS, FOR THIS REASON, OF GENERAL INTEREST.

428 DISPLAY CODING TECHNIQUES

SAENZ, N.E., & RICHE, C.V., JR. SHAPE AND COLOR AS DIMENSIONS OF A VISUAL REDUNDANT CODE. HUMAN FACTORS, 1974, 16, 308-313.
DESCRIPTION:

STUDIES HAVE BEEN CONDUCTED WHICH INDICATE THAT REDUNDANT CODING IS EFFECTIVE IN FACILITATING THE LOCATING OF A TARGET AMONG OTHER OBJECTS. ALL POSSIBLE COMBINATIONS OF FOUR SHAPES AND FOUR COLORS WERE USED AS TARGETS IN THE EXPERIMENT. THE TIMES TO LOCATE SIX EACH OF THE TARGETS AMONG 36 BACKGROUND OBJECTS FOR 16 DISPLAYS IN EACH OF THREE CODING CONDITIONS OF THE EXPERIMENT WERE DETERMINED FOR 24 SUBJECTS. THE TARGETS COULD BE DIFFERENTIATED FROM THE BACKGROUND OBJECTS ON THE BASIS OF COLOR ONLY, SHAPE ONLY, AND REDUNDANT COLOR/SHAPE. THE RESULTS INDICATE A DIFFERENCE AMONG CODING CONDITIONS, THE COLORS, AND THE SHAPES, AND IN THE CODE-BY-SHAPE AND CODE-BY-COLOR INTERACTIONS. AN IMPORTANT FINDING IS THAT THE REDUNDANT CODE AND THE COLOR CODE CONDITIONS DID NOT DIFFER. THE DATA ARE EXAMINED FOR POSSIBLE EXPLANATIONS OF THIS RESULT AND SOME IMPLICATIONS ARE SUGGESTED.

6P, 15R.

ALTHOUGH THE AUTHORS STRESS THE FACT THAT THE USE OF REDUNDANT CODING DOES NOT FACILITATE THE LOCATION OF TARGET OBJECTS AS COMPARED TO SINGLE DIMENSION CODING, THESE RESULTS ALSO INDICATE A SIGNIFICANT IMPROVEMENT IN VISUAL SEARCH TIME WHEN A COLOR CODE IS ADDED. THIS IS CONSISTENT WITH NUMEROUS OTHER STUDIES ON COLOR CODING. IN THE CONCEPT LEARNING LITERATURE, SOME ATTENTION HAS BEEN GIVEN TO PROBLEMS INVOLVING RELEVANT, REDUNDANT CUES, AND THIS IS VERY SIMILAR TO REDUNDANT CODING. THE PRINCIPAL RESULT IS THAT THE PROPORTION OF SUBJECTS WHO SOLVE THE PROBLEM ON THE BASIS OF ONE OR THE OTHER OF THE SINGLE CUES OR ON THE BASIS OF BOTH CUES IS A FUNCTION OF THE RELATIVE DOMINANCE OR SALIENCE OF THE SINGLE CUES. ALTHOUGH THE AUTHORS OF THIS PAPER ALLUDE TO THIS RESEARCH, THEY DO NOT ATTEMPT TO RELATE IT TO THEIR STUDY. THIS RESEARCH ON CONCEPT LEARNING APPEARS TO PROVIDE A USEFUL FRAMEWORK FOR INVESTIGATING THE EFFECTS OF CODING AND MAY AID IN CONSOLIDATING THE LITERATURE IN THIS AREA.

429 ADAPTIVE INFORMATION SELECTION AID SAMET, M.G., WELTMAN, G., & DAVIS, K.B. APPLICATION OF ADAPTIVE MODELS TO INFORMATION SELECTION IN C3 SYSTEMS (TECHNICAL REPORT PTR-1033-76-12). WOODLAND HILLS, CALIFORNIA: PERCEPTRONICS, INC., DECEMBER 1976. DESCRIPTION:

THIS REPORT DESCRIBES RESEARCH AND DEVELOPMENT CENTERED ON THE DEMONSTRATION OF AN ON-LINE ADAPTIVE MODEL FOR AUTOMATICALLY SELECTING INFORMATION IN A COMMAND, CONTROL, AND COMMUNICATION (C3) SYSTEM. RATIONALE FOR APPLICATION OF THE MODEL IS BUILT UPON A REVIEW OF PSYCHOLOGICAL LITERATURE CONCERNING HUMAN PERFORMANCE IN SPECIFYING INFORMATION REQUIREMENTS, AND IN ACQUIRING AND UTILIZING INFORMATION FOR MILITARY DECISION MAKING. A MULTI-ATTRIBUTE DECOMPOSITION OF INFORMATION MESSAGES, THE MODEL SELECTS INFORMATION FOR AN INDIVIDUAL USER ACCORDING TO HIS OBSERVED INFORMATION PREFERENCES IN RESPONSE TO SPECIFIC SITUATIONAL REQUIREMENTS. AN ADDITIONAL ALGORITHM REDUCES THE SIZE OF A SELECTED INFORMATION SET BY DYNAMICALLY PRUNING RELATIVELY LOW-UTILITY ITEMS. THE MODEL WAS IMPLEMENTED FOR A SIMULATED ASM TRACKING TASK, AND WAS SYSTEMATICALLY EVALUATED IN TERMS OF BOTH ITS INTRINSIC PERFORMANCE AND THE PERFORMANCE OF AN EXPERT OPERATOR WORKING WITH IT. THE RESULTS DEMONSTRATED THE CAPABILITY OF THE MODEL TO ADAPT TO VARIED INDIVIDUALIZED INFORMATION SEEKING STRATEGIES, AND TO SUBSEQUENTLY AUTOMATE THE SELECTION OF INFORMATION APPROPRIATE TO THOSE STRATEGIES. EMPIRICAL EVALUATIONS SHOWED THAT AN OPERATOR WAS ABLE TO PERFORM THE TRACKING TASK SUCCESSFULLY AND MUCH MORE RAPIDLY WITH AUTOMATIC SELECTION OF INFORMATION. MOREOVER, PERFORMANCE EFFECTIVENESS WAS ENHANCED BY THE REMOVAL OF MESSAGES WHICH CONTRIBUTED LITTLE TO THE OVERALL UTILITY OF AN INFORMATION SET. THE FINDINGS ARE DISCUSSED IN TERMS OF THE ADVANTAGES AND IMPLICATIONS OF THE ADAPTIVE, MULTI-ATTRIBUTE UTILITY MODEL AND ITS POTENTIAL APPLICATION FOR IMPROVING INFORMATION FLOW (E.G., PACING AND ROUTING) AND UTILIZATION IN COMPUTER-BASED C3 SYSTEMS. 103P, 44R.

COMMENTS:

THIS IS AN INTERESTING AND CLEARLY PRESENTED DISCUSSION OF ADAPTIVE AIDING IN A SIMULATED ANTI-SUBMARINE WARFARE TASK. THE BASIC CONCEPTS UNDERLYING THIS RESEARCH HAVE BEEN PRESENTED IN NUMEROUS PAPERS BY THESE AND OTHER (SEE PARTICULARLY A. FREEDY) AUTHORS. A BASIC THESIS OF THE RESEARCH DESCRIBED IN THIS PAPER IS THAT A HUMAN DECISION MAKER CAN BE CONFRONTED WITH MORE INFORMATION THAN HE CAN PROFITABLY USE, AND A USEFUL AID WOULD BE ONE THAT FILTERS THIS INFORMATION. FAILURE TO PRESENT ALL AVAILABLE INFORMATION CAN, IN SOME SITUATIONS, SERIOUSLY DEGRADE PERFORMANCE. THE FILTERING TECHNIQUES DESCRIBED HERE, HOWEVER, APPEAR TO BE ABLE TO SUBSTANTIALLY IMPROVE PERFORMANCE. ALTHOUGH THE THEORETICAL ARGUMENTS PRESENTED APPEAR TO BE SOUND, THE EMPIRICAL EVALUATION OF THE PROPOSED SYSTEM INVOLVED ONLY A SINGLE SUBJECT AND ADDITIONAL RESEARCH WOULD BE NECESSARY TO ACCURATELY EVALUATE THIS SYSTEM.

430 OPERATING SYSTEM LANGUAGES
SAYANI, H.H. A BASIS FOR THE DESIGN OF OPERATING SYSTEM COMMAND AND RESPONSE
LANGUAGES. IN ACM '76: PROCEEDINGS OF THE ANNUAL CONFERENCE. NEW YORK:
ASSOCIATION FOR COMPUTING MACHINERY, 1976, 373-380.
DESCRIPTION:

THE DESIGN OF COMMON OPERATING SYSTEM COMMAND AND RESPONSE LANGUAGES (OSCL/OSRL) REQUIRES AS A BASIS THE DEFINITION OF A USER'S VIEW OF THE COMMAND SYSTEM. THIS PAPER DISCUSSES THIS VIEW, DEFINES KEY CONCEPTS (SESSION, SESSION-BLOCKS) AS THEY RELATE TO A USER'S INFORMATION PRODUCING TASK. DESIRABLE LANGUAGE FEATURES ARE DISCUSSED ALONG WITH SUGGESTIONS FOR METHODS OF DEVELOPING COMMON OSCL/OSRL. (A)

COMMENTS:

FROM THE USER'S POINT OF VIEW, THERE ARE SEVERAL ADVANTAGES TO HAVING COMMON OPERATING SYSTEM COMMAND AND RESPONSE LANGUAGES. A MAJOR SOURCE OF DIFFICULTY MAY BE IN DEVELOPING LANGUAGES THAT SATISFY THE REQUIREMENTS OF USERS AT VARIOUS LEVELS OF EXPERIENCE. THE AUTHOR SUGGESTS THAT A COMPUTER SYSTEM CAN BE VIEWED AS A HIERARCHY OF SUBSYSTEMS AND THAT USERS CAN BE CHARACTERIZED BY THE LEVELS IN THIS HIERARCHY THAT THEY ACCESS. THIS MAY BE A USEFUL WAY TO CHARACTERIZE INTERACTIVE SYSTEMS AND AID IN DEVELOPING LANGUAGES THAT SATISFY DIVERSE USERS. ALTHOUGH VARIOUS FEATURES OF OPERATING SYSTEM COMMAND AND RESPONSE LANGUAGES ARE DISCUSSED IN SOME DETAIL, THE EFFECTS OF THESE FEATURES ON USER PERFORMANCE ARE NOT ADEQUATELY CONSIDERED. NEVERTHELESS, SOME OF THE SUGGESTIONS OFFERED IN THIS PAPER ARE QUITE GOOD AND OTHER SUGGESTIONS MAY LEAD TO USEFUL EMPIRICAL INVESTIGATIONS.

431 VISUAL TIME COMPRESSION

SCANLAM, L.A. VISUAL TIME COMPRESSION: SPATIAL AND TEMPORAL CUES. HUMAN FACTORS, 1975, 17, 337-345. DESCRIPTION:

PREVIOUS RESEARCH HAS DEMONSTRATED THE IMPROVED TARGET DETECTION PERFORMANCE RESULTING FROM THE COHERENT MOTION CUES PROVIDED BY A VISUALLY TIME—COMPRESSED RADAR DISPLAY (MOLL AND SCANLAN, 1972; SCANLAN, ROSCOE, AND WILLIGES, 1971). THESE STUDIES INDICATE THAT, AS THE DETECTION TASK BECOMES MORE DIFFICULT BECAUSE OF INCREASED NOISE AND CLUTTER, THE IMPROVEMENT DUE TO TIME COMPRESSION INCREASES. THE RESULTS OF THESE STUDIES FURTHER INDICATE THAT, IF THE SPATIAL ASPECT OF THE TARGET COULD ALSO BE ENHANCED, ADDITIONAL TARGET DETECTION IMPROVEMENT MIGHT BE REALIZED. THE PRESENT STUDY COMPARED TARGET DETECTION PREFORMANCE ON A STANDARD TIME-COMPRESSED DISPLAY WITH PERFORMANCE ON TWO DISPLAYS THAT PROVIDE BOTH SPATIAL AND TEMPORAL CUES. A FOURTH DISPLAY PROVIDING PRIMARILY SPATIAL CUES WAS ALSO INCLUDED IN THE COMPARISON. THE RESULTS INDICATE THAT THE ADDITION OF SPATIAL CUES IMPROVES THE DETECTABILITY OF A TARGET UNDER CONDITIONS OF HIGH NOISE AND THAT AT LEAST FIVE FRAMES OF STORAGE ARE REQUIRED FOR BEST PERFORMANCE. (A)

COMMENTS:

THIS PAPER DESCRIBES A VERY INTERESTING EXPERIMENT. THE AUTHOR CONSTRUCTED DISPLAYS THAT VARIOUSLY COMBINED AND SEPARATED SPATIAL AND TEMPORAL CUES. THIS IS A GOOD EXAMPLE OF THE TYPE OF CONTROLLED RESEARCH THAT IS NECESSARY TO BETTER UNDERSTAND HUMAN FACTORS ISSUES IN COMPUTER SYSTEMS. THE RESULTS OF THIS EXPERIMENT ARE CLEARLY REPORTED AND SHOULD BE OF INTEREST TO ANYONE CONCERNED WITH DISPLAY FACTORS IN TARGET DETECTION TASKS.

432 COMPARISON OF TIME-SHARING WITH BATCH PROCESSING SCHATZOFF, M., TSAO, R., & WIIG, R. AN EXPERIMENTAL COMPARISON OF TIME SHARING AND BATCH PROCESSING. COMMUNICATIONS OF THE ACM, 1967, 10, 261-265. DESCRIPTION:

THE EFFECTIVENESS FOR PROGRAM DEVELOPMENT OF THE MIT COMPATIBLE TIME-SHARING SYSTEM (CTSS) WAS COMPARED WITH THAT OF THE IBM IBSYS BATCH PROCESSING SYSTEM BY MEANS OF A STATISTICALLY DESIGNED EXPERIMENT. AN IDENTICAL SET OF FOUR PROGRAMMING PROBLEMS WAS ASSIGNED TO EACH OF A GROUP OF FOUR PROGRAMMING SUBJECTS. DATA WAS OBTAINED FOR SIX VARIABLES WHICH WERE CONSIDERED TO BE DEFINITIVE OF "SYSTEM EFFECTIVENESS", AND ANALYSIS OF VARIANCE TECHNIQUES WERE EMPLOYED TO ESTIMATE SYSTEM DIFFERENCES IN THESE VARIABLES. ANALYSI: ANALYSIS OF THE RESULTS PROVIDED STRONG EVIDENCE OF IMPORTANT SYSTEM DIFFERENCES. (A)

COMMENTS:

THE EMPHASIS IN THIS ARTICLE IS ON PROPER STATISTICAL DESIGN AND ANALYSIS. THE DISCUSSION IS, IN THAT REGARD, QUITE GOOD. HOWEVER, THE ARTICLE FAILS TO ATTEND ADEQUATELY TO THE POSSIBLE EXTRANEOUS DIFFERENCES BETWEEN THE TWO SYSTEMS EMPLOYED. IN FACT, THE PROPERTIES OF THE TWO SYSTEMS, FROM THE USER'S VIEWPOINT, ARE NOT DISCUSSED AT ALL. IT IS MADE CLEAR THAT THE PROGRAMMERS HAD NO PRIOR EXPERIENCE WITH TIME SHARING, AND PROBABLY DID NOT EMPLOY OPTIMAL DEVELOPMENT AND DEBUGGING STRATEGIES IN THIS MODE. WHETHER THIS MIGHT ACCOUNT FOR THE GREATER AMOUNT OF PROGRAMMER TIME (ADOUT TWICE AS MUCH) REQUIRED IN THE TIME-SHARING MODE OR THE GREATER NUMBER OF RUNS (MORE THAN TWICE AS MANY), IS UNCLEAR. IT DOES SEEM PROBABLE THAT EXPERIENCED TIME-SHARING USERS WOULD BE MORE EFFICIENT THAN WERE THESE SUBJECTS. IN GENERAL, THE SYSTEM AND TASK PROPERTIES ARE INADEQUATELY DISCUSSED.

433 USE OF ABBREVIATIONS IN DATA ENTRY

SCHOONARD, J.W., & BOIES, S.J. SHORT-TYPE: A BEHAVIORAL ANALYSIS OF TYPING SCHOONARD, J.W., & BOIES, S.J. SHORT-TYPE: A BEHAVIORAL ANALYSIS OF TYPING AND LEXT ENTRY. HUMAN FACTORS, 1975, 17, 203-214.

BESCHOOL EXILEMITY. HUMAN FACTORS, 1975, 17, 203-214.

THIS STUDY EVALUATED A TYPING TASK WHICH INCORPORATED AN ENCODING OPERATION. THIS TECHNIQUE, CALLED "SHORT-TYPE," TAKES ADVANTAGE OF WORD REPETITION TO REDUCE THE NUMBER OF KEYSTROKES REQUIRED TO TRANSCRIBE DOCUMENTS. FOUR TYPISTS WERE TAUGHT A LIST OF ABBREVIATIONS FOR FREQUENTLY OCCURRING WORDS. THEIR SUBSEQUENT TASK WAS TO ENTER DOCUMENTS INTO A COMPUTER VIA A STANDARD KEYBOARD. EACH TIME A WORD FROM THE TRAINING LIST WAS DETECTED, THE CORRESPONDING ABBREVIATION WAS TO BE TYPED IN ITS PLACE. IT WAS FOUND THAT: (1) OVER 93% OF THE TO-BE-ABBREVIATED WORDS WERE DETECTED BY THE TYPISTS; (2) THE ERROR RATE IN SELECTING AND TYPING ABBREVIATIONS WAS NO GREATER THAN THE ERROR RATE IN TYPING WORDS WHICH WERE NOT ABBREVIATED; AND (3) THE SUBSTITUTION PROCESS DID NOT ADVERSELY AFFECT THE KEYSTROKE RATE. IT WAS CONCLUDED THAT SHORT-TYPE IS A PRACTICAL TECHNIQUE IN IMPROVING TYPING PERFORMANCE. (A) 12P, 17R. COMMENTS:

THIS IS AN INTERESTING APPROACH TO INCREASING SPEED AND REDUCING ERRORS IN THE DATA ENTRY PROCESS. OBVIOUSLY, THE METHOD REQUIRES CONSIDERABLE TRAINING. PROBABLY FOR THAT REASON, ONLY FOUR SUBJECTS WERE USED IN THE STUDY. WHETHER THOSE SUBJECTS ARE REPRESENTATIVE OF TYPISTS AT LARGE IS PROBLEMATICAL. IN ANY EVENT, THE STUDY SHOWED ONLY THAT THE SUBJECTS'
PERFORMANCE WAS NOT HINDERED BY THE USE OF ABBREVIATIONS; NEITHER WAS THEIR PERFORMANCE IMPROVED. IT MAY BE THAT INCREASED EXPERIENCE OR OPTIMIZATION OF THE ABBREVIATED WORD LIST WOULD RESULT IN SIGNIFICANT GAINS USING THE TECHNIQUE. THE NEXT STEP IN THE DEVELOPMENT OF SUCH A PROCEDURE WOULD PRESUMABLY BE TO CAREFULLY SELECT A SET OF WORDS FOR ABBREVIATION, AS FREQUENTLY OCCURRING LONG WORDS, FREQUENTLY MISSPELLED WORDS, ETC., AND RERUN THE STUDY IN THE HOPE OF DEMONSTRATING SIGNIFICANT BENEFITS.

434 FORMATTING OF TREND DISPLAYS

SCHUTZ, H.G. AN EVALUATION OF FORMATS FOR GRAPHIC TREND DISPLAYS: EXPERIMENT II. HUMAN FACTORS, 1961, 3, 99-107.

DESCRIPTION:

THIS STUDY WAS DESIGNED TO DETERMINE WHICH OF THREE TYPES OF TREND FORMATS RESULTS IN SUPERIOR PERFORMANCE FOR A TASK REQUIRING THE SUBJECT TO MAKE COMPLEX DECISIONS. THREE COMMONLY USED FORMATS WERE INCLUDED IN THE STUDY: LINE TYPE, VERTICAL-BAR TYPE, AND HORIZONTAL-BAR TYPE. TWO SECONDARY INDEPENDENT VARIABLES WERE: NUMBER OF TIME POINTS AND AMOUNT OF MISSING DATA. RESULTS OF THE STUDY INDICATE THAT PREFERENCE SHOULD BE GIVEN TO LINE-TYPE GRAPHS, FOLLOWED CLOSELY BY THE VERTICAL-BAR TYPE. A SECONDARY FINDING WAS THAT IRRELEVANT POINTS AND MISSING DATA ON GRAPHIC TREND DISPLAYS REPRESENT IMPORTANT FACTORS IN THE DEGRADATION OF OPERATOR PERFORMANCE. (A)

COMMENTS:

THIS IS A RELATIVELY SIMPLE, STRAIGHT-FORWARD EXPERIMENT DEMONSTRATING THAT A LINE-TYPE GRAPH WAS SOMEWHAT BETTER THAN EITHER VERTICAL-BAR OR HGRIZONTAL-BAR TYPE GRAPHS IN TERMS OF BOTH SPEED AND ACCURACY IN DETECTING TRENDS. THE EXPERIMENTAL TASK, HOWEVER, WAS SOMEWHAT ARTIFICIAL AND THE RESULTS MAY NOT GENERALIZE TO OTHER TYPES OF TASKS. SUBJECTS WERE REQUIRED TO MEMORIZE A SET OF TEN POSSIBLE TREND VARIATIONS AND IDENTIFY AND NAME THE TREND IN EACH STIMULUS DISPLAY. THE TASK, THEREFORE, PRIMARILY INVOLVES COMPLEX PATTERN DETECTION AND THE RESULTS MAY OR MAY NOT APPLY TO SITUATIONS WHERE SUBJECTS MUST MAKE SUBJECTIVE DECISIONS ABOUT TRENDS.

435 FORMATTING OF TREND DISPLAYS

SCHUTZ, H.G. AN EVALUATION OF METHODS FOR PRESENTATION OF GRAPHIC MULTIPLE TRENDS: EXPERIMENT III. HUMAN FACTORS, 1961, 3, 108-119. DESCRIPTION:

THE PRIMARY OBJECTIVE OF THIS STUDY WAS TO DETERMINE THE EFFECT OF MULTIPLE-LINE VERSUS MULTIPLE-GRAPH PRESENTATION OF TREND-TYPE DISPLAYS ON OPERATOR PERFORMANCE. FOUR TYPES OF LINES HAVING LOW CONFUSABILITY WERE DETERMINED EXPERIMENTALLY FROM A SAMPLE OF TWENTY-FIVE LINES. THE PRIMARY VARIABLE WAS SINGLE-GRAPH, MULTIPLE-LINE PRESENTATION VERSUS MULTIPLE-GRAPH, SINGLE-LINE PRESENTATION. OTHER VARIABLES INCLUDED IN THIS STUDY WERE: NUMBER OF LINES, DEGREE OF CONFUSION AMONG LINES, CODING OF LINES, AND TWO OPERATOR TASKS: POINT-READING AND COMPARING. IT WAS FOUND THAT FOR THE POINT-READING TASK, EITHER TYPE OF DISPLAY IS ACCEPTABLE, BUT FOR THE COMPARING TASK, THE MULTIPLE-LINE DISPLAY IS MUCH SUPERIOR TO THE MULTIPLE-GRAPH DISPLAY. MORFOVER, THE USE OF COLOR CODING FOR THE GRAPH LINES TENDED TO IMPROVE PERFORMANCE SLIGHTLY. (A)

COMMENTS:

THE EXPERIMENT DESCRIBED HERE IS CLEARLY PRESENTED AND APPEARS TO HAVE BEEN CAREFULLY CONTROLLED. THE RESULTS INDICATE SEVERAL INTERACTIONS BETWEEN VARIOUS DISPLAY PARAMETERS AND THE SPECIFIC TASK TO BE PERFORMED. THIS HIGHLIGHTS THE FACT THAT IT IS NOT FEASIBLE TO POSTULATE A SET OF GENERAL, OPTIMAL DISPLAY PARAMETERS WITHOUT REFERENCE TO A SPECIFIC TYPE OF TASK. AS SUCH, THE CONCLUSIONS DERIVED FROM THIS STUDY SHOULD ONLY BE APPLIED TO POINT-READING AND COMPARISON TASKS AND SHOULD NOT BE GENERALIZED TO OTHER TYPES OF TASKS INVOLVING TREND DISPLAYS.

436 GENERAL DISCUSSION OF HUMAN FACTORS IN INTERACTIVE SYSTEMS
SCHWARTZ, B.K. THE MAN-LOGIC INTERACTION IN INFORMATION PROCESSING SYSTEMS.
IN PROCEEDINGS OF THE 16TH ANNUAL MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1972, 391-394.
DESCRIPTION:

IN THE PREFACE TO THE SPECIAL ISSUE OF HUMAN FACTORS ON "HUMAN FACTORS IN INFORMATION PROCESSING SYSTEMS," GLORIA GRACE (1970, PG. 161) MAKES THE POINT THAT THE ADDITION OF A LOGIC COMPONENT TO THE SYSTEM PARADIGM IS THE "SINGLE CHARACTERISTIC (WHICH) MOST CLEARLY DIFFERENTIATES THE INFORMATION PROCESSING SYSTEM FROM TRADITIONAL MAN-MACHINE SYSTEMS." TRADITIONALLY, CONSIDERATION OF THE MAN/MACHINE INTERFACE INVOLVED CONCERN OVER THE EXTERNAL SURFACE OF THE MACHINE AND ITS USEABILITY IN RELATION TO MAN'S PHYSICAL, PERCEPTUAL AND MENTAL ABILITIES. BECAUSE OF THE INTERDEPENDENT, RATHER THAN INDEPENDENT, NATURE OF THE RELATIONSHIP BETWEEN THE MANUAL AND MECHANIZED COMPONENTS IN AN INFORMATION PROCESSING SYSTEM, HUMAN FACTORS TECHNOLOGY APPLIED TO INFORMATION PROCESSING SYSTEMS MUST GO BEYOND CONSIDERATION OF THE EXTERNAL SURFACES OF THE MACHINE AND BECOME CONCERNED WITH THE EFFECTS OF DATA BASE DESIGN AND PROGRAM LOGIC ON THE PERFORMANCE OF THE PERSONNEL COMPONENT OF THE SYSTEM. THIS INTERRELATIONSHIP OF MAN WITH THE INTERNAL MACHINE PROCESSES IS THE MAN-LOGIC INTERACTION. THE PAPER DEFINES THE MAN-LOGIC INTERACTION, PRESENTS EXAMPLES OF THE EFFECT OF MACHINE PROCESSES ON HUMAN PERFORMANCE AND DISCUSSES THE IMPACT ON THE FIELD OF HUMAN FACTORS. (A)

4P, 4R.

THIS PAPER PROVIDES A BRIEF, EASY TO READ DISCUSSION OF THE NEED FOR HUMAN FACTORS INVOLVEMENT IN THE DESIGN OF INTERACTIVE SYSTEMS. INFORMATIVE EXAMPLES ARE PRESENTED TO ILLUSTRATE THE FACTORS INVOLVED IN DYNAMIC FUNCTION ALLOCATION, DATA BASE DESIGN, AND PROGRAM LOGIC. THE AUTHOR USES THE TERM "MAN-LOGIC INTERACTION" TO DESCRIBE THOSE AREAS OF MAN-COMPUTER INTERACTION THAT ARE RELATIVELY INDEPENDENT OF HARDWARE CONSIDERATIONS. THE AUTHOR ARGUES FOR MORE EXTENSIVE INVOLVEMENT OF HUMAN FACTORS PERSONNEL IN ALL STAGES OF SYSTEM DESIGN AND DEVELOPMENT.

437 REVIEW OF RESEARCH ON DATA ENTRY DEVICES AND PROCEDURES
SEIBEL, R. DATA ENTRY DEVICES AND PROCEDURES. IN H.P. VAN COTT & R.G. KINKADE
(EDS.), HUMAN ENGINEERING GUIDE TO EQUIPMENT DESIGN (REVISED ED.). WASHINGTON,
D.C.: U.S. GOVERNMENT PRINTING OFFICE, 1972, 311-344.
DESCRIPTION:

A WIDE VARIETY OF ALTERNATIVE MEANS FOR ENTERING DATA HAVE ACCOMPANIED THE AUTOMATION OF DATA HANDLING. THESE RANGE FROM KEYBOARDS, LEVERS, SWITCHES, AND DIALS TO LIGHT PENCILS, AND HANDWRITTEN OR VOICE INPUTS. THE SPEED AND ACCURACY WITH WHICH DATA ENTRY IS ACCOMPLISHED USING THESE DEVICES DEPENDS ON (A) THE CHARACTERISTICS OF THE SOURCE DATA, (B) THE DESIGN OF THE DATA ENTRY DEVICE, AND (C) THE CHARACTERISTICS OF THE OPERATOR. THIS CHAPTER PRESENTS RECOMMENDATIONS AND CROSS COMPARISONS FOR THE HUMAN ENGINEERING DESIGN OR SELECTION OF A VARIETY OF DATA ENTRY DEVICES, PROCEDURES, AND SOURCE DOCUMENT FORMATS. CONTINUOUS CONTROL DATA ENTRY DEVICES ARE NOT DISCUSSED HERE. (A & HRR) 34P, 111R.

### COMMENTS:

THIS IS A VERY CAREFUL, INTEGRATIVE REVIEW OF THE STATE OF OUR RESEARCH-SUPPORTED KNOWLEDGE CONCERNING DATA ENTRY DEVICES, PROCEDURES, AND OPERATOR PERFORMANCE. IT CONSISTS BASICALLY OF STATEMENTS CONCERNING THE CONCLUSIONS WHICH CAN BE DERIVED FROM A LARGE NUMBER OF EMPIRICAL STUDIES OF DATA ENTRY. THE REVIEW IS ALMOST TOTALLY DEVOID OF EITHER DESCRIPTION OR CRITICISM OF INDIVIDUAL EXPERIMENTS. THIS EMPHASIS, TOGETHER WITH THE FORMAT OF THE DOCUMENT, MAKE IT VERY GOOD FOR QUICK REFERENCE, BUT LEAVE THE READER SOMEWHAT UNCERTAIN AS TO WHETHER THE AUTHOR HAS TAKEN INTO ACCOUNT THE VARYING QUALITY OF THE RESEARCH EFFORTS WHICH HE REVIEWS, OR HAS INTEGRATED THE INDIVIDUAL CONCLUSIONS OF THESE STUDIES WITHOUT DIFFERENTIAL WEIGHTING. THUS, THE REVIEW STATES MANY RELATIONSHIPS (E.G., USE OF THIS PROCEDURE, KEYBOARD LAYOUT, ETC., APPEARS TO RESULT IN HIGHER DATA RATES WITH NO SIGNIFICANT EFFECT ON ERRORS THAN DOES THE OTHER PROCEDURE, KEYBOARD LAYOUT, OR WHATEVER) BUT FAILS TO CONVEY ANY NOTION OF THE RELATIVE DEGREE OF CONFIDENCE WE CAN HAVE IN THE "CORRECTNESS" OF THE CONCLUSION. THIS UNCERTAINTY IS MITIGATED SOMEWHAT BY THE AUTHOR'S OBVIOUS CAUTIOUSNESS, BUT A CLEARER STATEMENT OF INTENT MOULD HELP. THIS IS PROBABLY THE BEST SINGLE CURRENTLY AVAILABLE QUICK REFERENCE SOURCE FOR FACTUAL INFORMATION ABOUT DATA ENCODING, SOURCE FORMS, OPERATING PROCEDURES, KEYBOARD LAYOUT, LOCKOUT, CHORDED KEYBOARDS, ALTERNATIVE DISCRETE DATA ENTRY DEVICES, DATA ENTRY SPEED AND ERROR RATES, ETC. FOR MORE CRITICAL INSIGHT INTO RESEARCH METHODS, DESCRIPTIONS OF INDIVIDUAL STUDIES, ETC., SEE OTHER SOURCES, SUCH AS D.G. ALDEN, R.W. DANIELS, & A.F. KANARICK (1972).

438 EFFECT OF "LOCKOUT" ON MAN-COMPUTER PROBLEM SOLVING
SEVEN, M.J., BOEHM, B.W., & WATSON, R.A. A STUDY OF USER BEHAVIOR IN PROBLEMSOLVING WITH AN INTERACTIVE COMPUTER (REPORT NO. R-513-NASA). SANTA MONICA,
CALIFORNIA: RAND CORP., APRIL 1971.
DESCRIPTION:

AN EXPLORATORY INVESTIGATION TESTED THE EFFECTS OF FORCED TEMPORAL LOCKOUT INTERVALS ON USER PERFORMANCE IN AN INTERACTIVE MAN-COMPUTER PROBLEM SOLVING SITUATION. THENTY SUBJECTS PERFORMED A PLANNING TASK USING THE JOSS INTERACTIVE COMPUTER SYSTEM AS A DECISION MAKING AID. IN THE LOCKOUT CONDITIONS, THE SUBJECT'S TERMINAL WAS MECHANICALLY LOCKED OUT OF THE SYSTEM FOR A SPECIFIED LENGTH OF TIME AFTER EACH TRIAL, I.E., AFTER HE HAD RECEIVED A CURRENT SET OF RESULTS.

IN GENERAL, THE SUBJECTS HAVING A 5-MIN. LOCKOUT PERIOD AFTER EACH TRIAL NOT ONLY ACHIEVED BETTER SOLUTIONS TO THE PROBLEM THAN DID THE CONTROL (NO LOCKOUT) GROUP, BUT THEY ALSO USED FAR LESS COMPUTER TIME AND LESS TOTAL WORKING TIME. A LONGER LOCKOUT PERIOD (8 MIN.) APPEARED TO BE DISRUPTIVE, ESPECIALLY FOR MORE EXPERIENCED SUBJECTS.

OTHER FINDINGS SUGGEST THAT SELF-IMPOSED RESTRAINTS, SUCH AS THAT RESULTING FROM A RESTRICTIVE CHARGE ALGORITHM, CAN ALSO IMPROVE PROBLEM SOLVING EFFICIENCY, AND THAT THE USERS' ACCEPTANCE OF THE SYSTEM IS NOT NECESSARILY A VALID PREDICTOR OF SYSTEM EFFECTIVENESS. (A) 50P, 10R.

# COMMENTS:

A BRIEFER AND MORE READILY AVAILABLE DISCUSSION OF THIS EXPERIMENT HAS BEEN PRESENTED BY B.W. BOEHM, M.J. SEVEN, AND R.A. WATSON (1971). THE PRESENT PAPER DIFFERS PRIMARILY IN THAT IT PRESENTS STATISTICAL ANALYSES AND PROVIDES MORE GRAPHICAL AND TABULAR DESCRIPTIONS OF THE DATA.

439 COMPUTER CONSOLE DESIGN
SHACKEL, B. ERGONOMICS IN THE DESIGN OF A LARGE DIGITAL COMPUTER CONSOLE.
ERGONOMICS, 1962, 5, 229-241.
DESCRIPTION:

THIS STUDY WAS PART OF THE RE-DESIGN STAGE FOR A PRODUCTION SERIES OF MACHINES AFTER A FIRST ENGINEERING PROTOTYPE HAD BEEN DESIGNED. THE APPROACH ADOPTED IN THIS STUDY WAS, AFTER A GENERAL INDOCTRINATION, TO LEARN AND LIST THE FUNCTIONS OF ALL THE VARIOUS PANELS AND COMPGNENTS, AND THE INFORMATION TO BE TRANSMITTED BETWEEN OPERATOR AND MACHINE THROUGH THEM. FROM THIS INFORMATION, AN ORDER OF IMPORTANCE AND A FREQUENCY OF USE COULD BE ASSESSED AND THE EASE OR DIFFICULTY FOR THE OPERATOR IN SEARCHING FOR, ACQUIRING, AND TRANSMITTING BACK INFORMATION TO THE MACHINE COULD BE STUDIED. SOME OF THE CHANGES PROPOSED FOR THE PROTOTYPE ARE ILLUSTRATED IN A "BEFORE" AND "AFTER" MANNER, THE AIM BEING DIRECTLY TO EXEMPLIFY ERGONOMICS AT WORK, I.E., THE APPLICATION OF BIOLOGICAL SCIENCE KNOWLEDGE TO PY ACTICAL PROBLEMS OF HUMANS IN A WORKING ENVIRONMENT. (A, ABBR.) 13P, 7R.

COMMENTS:

THIS IS A VERY CLEAR EXAMLE OF THE ROLE OF HUMAN FACTORS PERSONNEL IN THE DESIGN OF A COMPUTER OPERATOR'S CONSOLE. NUMEROUS "BEFORE" AND "AFTER" EXAMPLES AID THE READER IN RECOGNIZING HUMAN FACTORS PROBLEMS IN THE PROTOTYPE DESIGN AND RECOGNIZING HOW THESE PROBLEMS WERE ELIMINATED. THE USE OF EXAMPLES, RATHER THAN DETAILED DISCUSSIONS, MAKES THIS A GOOD INTRODUCTORY PAPER FOR THOSE UNFAMILIAR WITH THE ROLE OF HUMAN FACTORS IN EQUIPMENT DESIGN.

440 GENERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
SHACKEL, B. MAN-COMPUTER INTERACTION: THE CONTRIBUTION OF THE HUMAN SCIENCES.
ERGONOMICS, 1969, 12, 485-499.
DESCRIPTION:

AN INTRODUCTORY SURVEY IS PRESENTED OF THE POSSIBLE CONTRIBUTION OF THE HUMAN SCIENCES TO MAN-COMPUTER INTERACTION, BASED UPON A FULL REVIEW OF THE RELEVANT HUMAN FACTORS LITERATURE WHICH IS TO BE PUBLISHED. A POSSIBLE TAXONOMY FOR THE FIELD IS PROPOSED FOUNDED ON BROAD DIVISIONS OF THE HUMAN SCIENCES PROBLEM AREAS AND OF THE TYPES OF COMPUTER SYSTEMS AND SERVICES. USING THE TAXONOMY AS A FRAMEWORK, SOME EXAMPLES OF RELEVANT HUMAN SCIENCES WORK AND SOME PROBLEMS AND RESEARCH NEEDS ARE DISCUSSED. (A) 15P, 36R.

COMMENTS:

BECAUSE OF ITS BREVITY, THIS BROAD OVERVIEW OF THE FIELD DOES NOT PRESENT MUCH DETAIL IN ANY ONE AREA. IT DOES, HOWEVER, PRESENT THE AUTHOR'S OVERALL VIEW OF THE FIELD, ITS COMPONENT AREAS, AND ITS PROBABLE FUTURE DEVELOPMENT. IT IS WELL WORTH READING BY ANYONE ATTEMPTING TO GAIN AN OVERVIEW, BUT DOES NOT CONTAIN ENOUGH INFORMATION TO BE HELPFUL WITH ANY SPECIFIC PROBLEMS.

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441 BROAD REVIEW OF MAN-COMPUTER INTERACTION
SHACKEL, B., & SHIPLEY, P. MAN-COMPUTER INTERACTION: A REVIEW OF ERGONOMICS
LITERATURE AND RELATED RESEARCH (REPORT NO. DMP-3472). HAYES, MIDDLESEX,
ENGLAND: EMI ELECTRONICS LTD., FEBRUARY 1970.
DESCRIPTION:

THIS REPORT SUMMARIZES A FAIRLY EXTENSIVE LITERATURE REVIEW IN THE AREA OF MAN-COMPUTER INTERACTION. THE AUTHORS INDICATE THAT THE REPORT CONTAINS SOME INTERPRETATION, BUT IS INTENDED PRIMARILY TO PRESENT THE CURRENT STATE OF KNOWLEDGE AND POINT OUT SOME RESEARCH GAPS, RATHER THAN TO SERVE AS A DESIGN GUIDE OR HANDBOOK. ALTHOUGH SOME GENERAL QUESTIONS ARE ADDRESSED, SUCH AS THE RELATIVE EFFECTIVENESS OF TIME-SHARING AND BATCH PROCESSING AND THE EFFECTS OF SYSTEM RESPONSE TIME ON THE USER, THE REVIEW STRONGLY EMPHASIZES INPUT AND OUTPUT DEVICES AND TECHNIQUES.

119P, 202R.

COMMENTS:

THIS IS PROBABLY THE BROADEST REVIEW OF THE ERGONOMIC ASPECTS OF MAN-COMPUTER COMMUNICATION DEVICES WHICH HAS YET APPEARED. IT DISCUSSES THE LOGICAL PROPERTIES AND RESEARCH RESULTS FOR EVERYTHING FROM THUMBWHEELS TO THREE-DIMENSIONAL GRAPHICAL DISPLAYS. WHILE SLIGHTLY DATED, IT IS AN EXCELLENT REVIEW, AND DESERVES THE ATTENTION OF ANYONE CONCERNED WITH IMPUT AND OUTPUT DEVICES AND TECHNIQUES.

442 USER PERFORMANCE IN A TIME-SHARING SYSTEM
SHAW, J.C. JOSS: EXPERIENCE WITH AN EXPERIMENTAL COMPUTING SERVICE FOR USERS
AT REMOTE TYPEWRITER CONSOLES (REPORT NO. P-3149). SANTA MONICA, CALIFORNIA:
THE RAND COR?., MAY 1965.

DESCRIPTION:

MANY DISCUSSIONS OF THE RELATIVE ADVANTAGES OF ON-LINE AND OFF-LINE SYSTEMS FOCUS ON THE RELATIVE COSTS AND IGNORE THE RELATIVE BENEFITS. THIS PAPER PRESENTS AN INFORMAL DESCRIPTION OF JOSS (JOHNNIAC OPEN-SHOP SYSTEM) AND OF USER EXPERIENCES WITH AND ATTITUDES TOWARD JOSS.

19P, 7R.

COMMENTS:

THIS IS ONE OF SEVERAL PAPERS THAT DESCRIBE THE JOSS SYSTEM. A FAIRLY THOROUGH TREATMENT OF SYSTEM USE AND INDIVIDUAL USER CHARACTERISTICS HAS BEEN PRESENTED BY G.E. BRYAN (1967). THE PRESENT PAPER PROVIDES ONLY A VERY INFORMAL DISCUSSION OF JOSS AND OF THE ADVANTAGES OF INTERACTIVE SYSTEMS AS SEEN BY THE USER.

443 SYSTEM EVALUATION TECHNIQUE

SHELDON, M.S., & ZAGORSKI, H.J. MAN-MACHINE SYSTEM EVALUATION: THE NORMATIVE OPERATIONS REPORTING METHOD. IN R.E. BLANCHARD & D.H. HARRIS (EDS.), MAN-MACHINE EFFECTIVENESS ANALYSIS: A SYMPOSIUM OF THE HUMAN FACTORS SOCIETY, LOS ANGELES CHAPTER, JUNE 1967. (NTIS NO. AD 735718) DESCRIPTION:

THE RAPID DEVELOPMENT OF MILITARY MAN-MACHINE SYSTEMS IN THE LAST DECADE HAS PRESENTED NEW PROBLEMS FOR PEOPLE CONCERNED WITH SYSTEM MEASUREMENT AND EVALUATION. CONCEPTS LIKE MEAN TIME BETWEEN FAILURE (MTBF) OR CIRCULAR ERROR PROBABILITY (CEP) AND THE CLASSICAL PSYCHOMETRIC APPROACHES ARE NOT SUFFICIENT TO PERMIT ADEQUATE ASSESSMENT OF THE COMPLEX BEHAVIOR OF A SYSTEM. IT IS BECOMING INCREASINGLY EVIDENT THAT MAN-MACHINE SYSTEM EVALUATION CALLS FOR TECHNIQUES THAT ARE RADICALLY DIFFERENT FROM THOSE WHICH PERSEVERE BY TRADITION. WE PROPOSE THAT THIS KIND OF WORK AREA BE CALLED SYSTEMETRICS. AS AN EXAMPLE OF THE KIND OF WORK THAT CAN BE DONE, WE ARE GOING TO DESCRIBE THE "NORMATIVE OPERATIONS REPORTING METHOD" (NORM), WHICH IS CURRENTLY BEING APPLIED IN FIELD EVALUATIONS OF THE SAGE SYSTEM.

THIS PAPER IS ORGANIZED INTO FOUR SECTIONS. FIRST, THE SAGE ENVIRONMENT WILL BE DESCRIBED IN SUFFICIENT DETAIL TO ALLOW THE READER TO GAIN SOME APPRECIATION OF THE MEASUREMENT AND EVALUATION PROBLEMS. THEN, THE SAGE CREW PERFORMANCE CRITERION DEVELOPMENT PROCEDURES WILL BE DISCUSSED. THE THIRD SECTION WILL OUTLINE IN DETAIL THE DEVELOPMENT OF THE NORMATIVE EVALUATION METHODOLOGY, AND IN THE LAST SECTION WE WILL TRY TO SHOW THE APPLICABILITY OF THIS METHODOLOGY TO OTHER SYSTEMS. (A,ABBR.) 9P, GR.

COMMENTS:

THE PRINCIPAL DIFFERENCE BETWEEN THE NORMATIVE OPERATIONS REPORTING PROCEDURE AND MORE STANDARD EVALUATION TECHNIQUES IS THAT THE FORMER METHOD PERMITS AN EVALUATION OF MAN-MACHINE PERFORMANCE WHICH IS BASED ON A SERIES OF FLEXIBLE STANDARDS THAT REFLECT MISSION DIFFICULTY RATHER THAN ON AN ABSOLUTE SET OF MISSION STANDARDS. IN ADDITION, THE NORM PROCEDURE REQUIRES THE EVALUATOR OF A SYSTEM TO BECOME VERY FAMILIAR WITH THAT SYSTEM AND ITS UNIQUE PROPERTIES. TAKEN TOGETHER, THESE FACTS TEND TO RESULT IN EVALUATIONS THAT ARE NOT ONLY MORE ACCURATE BUT THAT ARE ALSO MORE MEANINGFUL TO SYSTEM PERSONNEL. PERFORMANCE CRITERION MEASURES ARE DETERMINED BY ANALYZING THE SYSTEM'S MISSION OBJECTIVES AND THE FUNCTIONS REQUIRED TO MEET THESE OBJECTIVES. THE IMPORTANCE OF EACH OF THESE CRITERIA IN SYSTEM PERFORMANCE IS THEN DETERMINED BY CONSIDERING THEIR CORRELATIONS WITH VARIOUS SYSTEM DIFFICULTY VARIABLES. ALTHOUGH THIS METHOD OF DEFINING CRITERION VARIABLES SEEMS USEFUL, THE AUTHORS DO NOT ADEQUATELY DESCRIBE HOW MISSION DIFFICULTY VARIABLES ARE DEFINED. EVEN THOUGH ONLY THE RESULTS OF SOME PRELIMINARY EVALUATIONS ARE REPORTED, THIS EVALUATION PROCEDURE APPEARS TO BE USEFUL.

444 MODEL OF RESPONSE TIME IN COMBINED TIME-SHARING/BATCH SYSTEM SHEMER, J.E., & HEYING, D.W. PERFORMANCE MODELING AND EMPIRICAL MEASUREMENTS IN A SYSTEM DESIGNED FOR BATCH AND TIME-SHARING USERS. AFIPS CONFERENCE PROCEEDINGS, 1969, 35, 17-26.

DESCRIPTION:

IN DESIGNING A SYSTEM INTENDED FOR BOTH BATCH AND TIME-SHARING USE, SOME COMPROMISE MUST BE REACHED BETWEEN EXTERNAL RESPONSE RAPIDITY AND INTERNAL EFFICIENCY. PERFORMANCE IN SUCH A SYSTEM IS A FUNCTION OF HARDWARE, SOFTWARE, AND USER CHARACTERISTICS. THIS PAPER PRESENTS A MATHEMATICAL MODEL THAT CAN BE UTILIZED TO ANALYZE SUCH SYSTEMS. A SET OF VARIABLES IS DEFINED TO CHARACTERIZE ON-LINE USER DEMANDS AND SYSTEM CAPABILITIES. THESE VARIABLES ARE THEN RELATED IN A MODEL TO YIELD SALIENT SYSTEM PERFORMANCE MEASURES AND THESE ESTIMATES ARE COMPARED WITH EMPIRICALLY DETERMINED VALUES.

COMMENTS:

A PROPER APPRECIATION OF RESPONSE-TIME TRADEOFFS REQUIRES AN UNDERSTANDING NOT ONLY OF THE NEEDS OF THE USER, BUT ALSO OF THE CAPABILITIES OF EXISTING HARDWARE AND SOFTWARE. THIS IS NOT A BEHAVIORAL PAPER, BUT IT IS INCLUDED IN THE BIBLIOGRAPHY BECAUSE IT CONVEYS AN APPRECIATION OF SOME OF THE FACTORS INVOLVED IN THE COMPUTER SIDE OF THIS ISSUE. FROM A HUMAN FACTORS POINT OF VIEW, THE MODEL MAY PROVIDE A USEFUL CONTEXT FOR ADDRESSING SOME OF THE DEFICIENCIES OF EXISTING SYSTEM SOFTWARE. FOR EXAMPLE, THE MODEL ASSUMES EQUAL PRIORITY FOR ALL USERS AND ON-LINE TRANSACTION TYPES (CF. R.B. MILLER, 1968).

445 DECISION-AIDING MECHANISMS
SHUFORD, E.H., JR. A COMPUTER-BASED SYSTEM FOR AIDING DECISION MAKING. IN
SECOND CONGRESS ON THE INFORMATION SYSTEM SCIENCES. WASHINGTON, D.C.: SPARTAN
BOOKS, 1965, 157-168.
DESCRIPTION:

IN A BROADLY CONCEIVED AND SOMEWHAT TRIVIAL SENSE, MOST APPLICATIONS OF COMPUTERS CAN BE INTERPRETED AS ATTEMPTS TO IMPROVE THE QUALITY OF DECISIONS. INFORMATION SYSTEMS FOR THE MILITARY AS WELL AS INFORMATION RETRIEVAL SYSTEMS FOR THE SCIENTIST AND ENGINEER CAN BE VIEWED AS ATTEMPTS TO IMPROVE THE QUALITY OF DECISIONS BY PROVIDING AN INCREASED AMOUNT OF TIMELY INFORMATION TO THE DECISION MAKER. COMPUTER-CONTROLLED PRODUCTION PROCESSES AND ACCOUNTING PROCEDURES CAN BE SEEN AS ATTEMPTS TO IMPROVE THE EFFECTIVENESS OF DECISIONS BY PROVIDING FOR THE RELIABLE AND TIMELY REALIZATIONS OF PLANS PREVIOUSLY SELECTED BY THE DECISION MAKER. AN INDIVIDUAL, E.G., A MILITARY COMMANDER OR STAFF OFFICER, A BUSINESS MANAGER, A DESIGN ENGINEER, OR A SCIENTIST HAS A PROBLEM TO SOLVE OR A PLAN TO PREPARE. HOW CAN BE HE HELPED IN THE ACTUAL PERFORMANCE OF THE DECISION PROCESS ITSELF? ARE THERE ANY MATHEMATICS AVAILABLE THAT MIGHT BE USED TO GIVE LOGICAL CONSISTENCY TO HIS DECISIONS AND TO AID HIS UNDERSTANDING OF THE NATURE OF THE DECISION PROBLEM? WHAT ROLE MIGHT A COMPUTER BE EXPECTED TO PERFORM IN THIS PROCESS? THESE ARE THE QUESTIONS THAT I WOULD LIKE TO CONSIDER IN SOME DETAIL. (A, ABBR.)

COMMENTS:

THE PRIMARY EMPHASIS OF THIS PAPER IS ON DESCRIBING THE BENEFITS OF INCORPORATING MATHEMATICAL DECISION THEORY INTO INTERACTIVE PROBLEM-SOLVING SYSTEMS AND ON DESCRIBING ONE SUCH SYSTEM (CORTEX). MORE RECENT PAPERS (E.G., J.S. DYER, 1973) PRESENT SIMILAR ARGUMENTS -- THE PRINCIPAL ADVANTAGE OF SUCH SYSTEMS IS THAT THEY AID IN CHECKING THE CONSISTENCY OF THE DECISION MAKER'S JUDGMENTS. THE SYSTEM DESCRIBED IN THIS PAPER, HOWEVER, AIDS THE PROBLEM SOLVER IN SUCH TASKS AS ENUMERATING ALTERNATIVES, GENERATING THE CONSEQUENCES OF ALTERNATIVES, ETC. THERE ARE OBVIOUS ADVANTAGES TO DEVELOPING INTERACTIVE PROBLEM-SOLVING OR DECISION-MAKING SYSTEMS. IT MAY BE A MORE USEFUL APPROACH TO IDENTIFY AND THEN AUGMENT THE PROCESSES USED BY HUMAN PROBLEM SOLVERS RATHER THAN TO IMPOSE A STRUCTURED PROCESS SUCH AS MATHEMATICAL DECISION THEORY.

446 PROPERTIES OF DISPLAYS

SIEGEL, A.I., & FISCHL, M.A. DIMENSIONS OF VISUAL INFORMATION DISPLAYS. JOURNAL OF APPLIED PSYCHOLOGY, 1971, 55, 470-476. DESCRIPTION:

TWELVE AIR-DEFENSE-ORIENTED VISUAL INFORMATION DISPLAYS, REPRESENTING ALL COMBINATIONS OF THREE DENSITIES OF AIR THREAT (5, 10, 15 THREATS), TAO DIFFERENT PRIMARY DISPLAY FORMATS (PICTORIAL, TABULAR), AND TWO CONDITIONS OF INFORMATION CODING (COLOR CODED, NOT COLOR CODED), WERE EXPOSED TO THREE SUBJECT GROUPS IN ORDER TO DETERMINE THE NATURE AND STRUCTURE OF THE DISPLAY-OBSERVER INTERFACE. THE SUBJECT GROUPS POSSESSED DIFFERENT DEGREES OF FAMILIARITY WITH THE DISPLAYS AND THE TACTICAL CONCEPTS INVOLVED IN THEIR USE. SUBJECTS RATED ALL PAIRS OF DISPLAYS FOR SIMILARITY, DISSIMILARITY. INDEPENDENT MULTIDIMENSIONAL SCALING ANALYSES WERE PERFORMED ON THE DATA DERIVED FROM EACH GROUP. SEVEN DIMENSIONS, WHICH WERE CONGRUENT ACROSS SUBJECT GROUPS, MERE ISOLATED. THE PATTERNS OF FACTOR LOADINGS SUGGESTED INTERPRETATION IN TERMS OF: (A) STIMULUS NUMEROSITY, (B) PRIMARY CODING, (C) CONTEXTUAL DISCRIMINATION, (D) STRUCTURE SCANNING, (E) CRITICAL RELATIONSHIPS, (F) CUE INTEGRATION, AND (G) COGNITIVE PROCESSING. (A & HRR) 7P, 8R.

COMMENTS:

FACTOR ANALYTIC STUDIES ARE ALMOST INVARIABLY SUBJECT TO THE CRITICISM THAT THEIR INTERPRETATION IS HIGHLY SUBJECTIVE, AND THIS STUDY IS NO EXCEPTION. THE EXTRACTION OF SEVEN PSYCHOLOGICAL FACTORS FROM 12 POINTS IN A THREEDIMENSIONAL STIMULUS SPACE IS SUFFICIENT TO AROUSE GREATER THAN USUAL SKEPTICISM. TOO, THE FACTOR STRUCTURE IS PROBABLY HEAVILY INFLUENCED BY THE PARTICULAR STIMULUS DIMENSIONS CHOSEN. THIS STUDY IS NONETHELESS A SUGGESTIVE FIRST STEP TOWARD A SERIOUS THEORY OF DISPLAY PERCEPTION AND USE, AND SEVERAL OF THE FACTORS ARE EXPLAINED IN A BELIEVABLE AND USEFUL WAY. THE PAPER SHOULD BE READ BY THOSE WITH AN INTEREST IN THE THEORY OF DISPLAYS AND BY THOSE WITH AN EXHAUSTIVE INTEREST IN THE EFFECTS OF USER EXPERIENCE AND COLOR CODING.

447 EVALUATION OF DISPLAYS

SIEGEL, A.I., FISCHL, M.A., & MACPHERSON, D.H. A FORCED-CHOICE INSTRUMENT FOR EVALUATING VISUAL INFORMATION DISPLAYS. WAYNE, PENNSYLVANIA: APPLIED PSYCHOLOGICAL SERVICES, INC., 1969. (NTIS NO. AD 687182) DESCRIPTION:

AN INSTRUMENT (CALLED THE ANALYTIC PROFILE SYSTEM, APS) FOR VISUAL DISPLAY EVALUATION WAS DEVELOPED AND SUBJECTED TO AN INITIAL VALIDATION. THE APS IS BASED ON SEVEN FACTORS DERIVED FROM A MULTIDIMENSIONAL SCALING ANALYSIS OF THE DISPLAY-OBSERVER INTERFACE. PROSE STATEMENTS (ITEMS) WERE PREPARED COVERING THESE DIMENSIONS, WERE SCALED FOR FAVORABLENESS, AND WERE THEN ARRANGED IN TETRAD FORCED-CHOICE FORMAT. THE REPORT PRESENTS RESULTS OF INVESTIGATIONS INTO THE DIMENSIONAL HOMOGENEITY, AND INTO THE CONCURRENT VALIDITY, EQUIVALENCE, AND STABILITY OF THE DEVELOPED INSTRUMENT. A COPY OF THE FINAL FORM IS INCLUDED. (A) 76P, 32R.

COMMENTS:

THE TECHNIQUE DESCRIBED IN THIS PAPER MAY, AS CLAIMED, PROVIDE AN EASILY ADMINISTERED AND SCORED INSTRUMENT FOR DISPLAY EVALUATION. IT IS NOT CLEAR, HOWEVER, HOW THE RESULTS OF THIS EVALUATION PROCEDURE SHOULD BE INTERPRETED. THIS PROCEDURE PROVIDES A SCORE ON EACH OF SEVEN DIMENSIONS AS WELL AS A TOTAL SCORE. WHILE A LOW SCORE ON ONE DIMENSION MAY MEAN THAT MORE ATTENTION SHOULD BE GIVEN TO THIS ASPECT OF THE DISPLAY, IT MAY ALSO MEAN THAT THIS DIMENSION IS NOT RELEVANT FOR THE SPECIFIC TYPE OF DISPLAY BZING EVALUATED. THIS TECHNIQUE MAY BE QUITE USEFUL IF IT CAN BE COUPLED APPROPRIATELY WITH AN UNDERSTANDING OF TASK REQUIREMENTS.

448 EVALUATION OF DISPLAYS

SIEGEL, A.I., FISCHL, M.A., & MACPHERSON, D. THE ANALYTIC PROFILE SYSTEM (APS) FOR EVALUATING VISUAL DISPLAYS. HUMAN FACTORS, 1975, 17, 278-288. DESCRIPTION:

A DISPLAY EVALUATIVE TOOL CALLED THE "ANALYTIC PROFILE SYSTEM" (APS) WAS DEVELOPED AND TESTED. THE SCORABLE FACTORS INCLUDED IN THE APS ARE BASED ON THE RESULTS OF A MULTIDIMENSIONAL SCALING OF THE DISPLAY-OBSERVER INTERFACE. THE TECHNIQUE ITSELF RESTS ON FORCED-CHOICE METHODS AND IS HELD TO POSSESS ACCEPTABLE PSYCHOMETRIC CHARACTERISTICS. (A) 11P, 12R.

COMMENTS:

THIS IS A BRIEF VERSION OF A PAPER ORIGINALLY PRESENTED BY A.I. SIEGEL, M.A. FISCHL, AND D.H. MACPHERSON (1969). ALTHOUGH THE CURRENT PAPER PROVIDES A REASONABLE INTRODUCTION TO THIS DISPLAY EVALUATION TECHNIQUE, THOSE WISHING TO APPLY THIS TECHNIQUE IN THEIR OWN WORK WILL NEED TO CONSULT THE ORIGINAL PAPER FOR THE APPROPRIATE DETAILS.

449 MODEL OF HUMAN PERFORMANCE RELIABILITY

SIEGEL, A.I., LEAHY, W.R., & WIESEN, J.P. APPLICATIONS OF HUMAN PERFORMANCE RELIABILITY EVALUATION CONCEPTS AND DEMONSTRATION GUIDELINES. WAYNE, PENNSYLVANIA: APPLIED PSYCHOLOGICAL SERVICES, INC., MARCH 1977. (NTIS NO. AD AD37632)

DESCRIPTION:

ALTHOUGH THE IMPROVEMENT OF EQUIPMENT SYSTEMS FOR HUMAN OPERATION AND MAINTENANCE HAS BEEN STRESSED FOR MANY YEARS, THE ACTUAL MEASUPEMENT AND SPECIFICATION OF HUMAN PERFORMANCE RELIABILITY IN CONCRETE TERMS HAS BEEN LARGELY IGNORED. A SET OF COMPUTER SIMULATION MODELS, WHICH ASSESS THE HUMAN PERFORMANCE RELIABILITY OF A SYSTEM WHILE THE SYSTEM IS IN THE EARLY DESIGN STATE, WAS PREVIOUSLY DEVELOPED. THE RESULTS OF TRIAL APPLICATION OF THESE SIMULATION MODELS TO AN ACTUAL SYSTEM, WHICH IS UNDER DEVELOPMENT, ARE PRESENTED. ADDITIONALLY, A SET OF GUIDELINES IS PRESENTED WHICH CAN FORM THE BASIS FOR A HUMAN PERFORMANCE RELIABILITY DEMONSTRATION IN FUTURE MAVY SYSTEMS. (A) 161P, 12R.

COMMENTS:

THE MODELS DESCRIBED HERE ARE MORE CONCERNED WITH THE TASK TO BE PERFORMED THAN WITH THE HUMAN OPERATOR. A TASK IS DECOMPOSED INTO SUBTASKS AND THE PROBABILITY OF COMPLETING EACH SUBTASK ACCURATELY AND ON TIME IS VARIED TO DETERMINE OVERALL SYSTEM PERFORMANCE. ALTHOUGH SOME PARAMETERS OF THE MODELS ARE INTENDED TO REFLECT HUMAN PERFORMANCE VARIABLES, ONLY A LIMITED NUMBER OF POTENTIALLY RELEVANT VARIABLES ARE CONSIDERED AND ONLY AT A FAIRLY SUPERFICIAL LEVEL. SUCH MODELS, HOWEVER, MAY BE VERY USEFUL IN MODELING OVERALL SYSTEM PERFORMANCE, PROVIDED THAT THEIR VALIDITY CAN BE DEMONSTRATED. DEMONSTRATING VALIDITY MAY PROVE TO BE A VERY DIFFICULT TASK, AND IT IS NOT ADEQUATELY CONSIDERED IN THIS PAPER.

450 SIMULATION MODEL OF INTERACTIVE MESSAGE-HANDLING SYSTEM SIEGEL, A.I., WOLF, J.J., & LEAHY, W.R. A DIGITAL SIMULATION MODEL OF MESSAGE HANDLING IN THE TACTICAL OPERATIONS SYSTEM: I. THE MODEL, ITS SENSITIVITY, AND USER'S MANUAL (RESEARCH MEMORANDUM 73-5). ARLINGTON, VIRGINIA: U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES, NOVEMBER 1973. (NTIS NO. AD AD47104) DESCRIPTION:

THE RESULTS OF RESEARCH INTO IMPLEMENTATION OF A QUANTITATIVE MODEL OF HUMAN PERFORMANCE IN INFORMATION SYSTEMS ARE PRESENTED. THE PRINCIPAL EFFORTS WERE TO: (1) DEFINE THE MOST INFLUENTIAL PSYCHO-SOCIAL VARIABLES INHERENT IN THE MISSION OF INTEREST, (2) INCORPORATE THESE INTO A LOGIC FOR A DIGITAL SIMULATION MODEL, AND (3) DEVELOP A COMPUTER PROGRAM REFLECTING THIS MODEL. THE TACTICAL OPERATIONS SYSTEM (TOS) FOR WHICH THE MODEL WAS DEVELOPED, IS DESCRIBED, AND MODEL FEATURES INVOLVING PREDICTIVE CAPABILITY AND SYSTEM EFFECTIVENESS MEASUREMENTS ARE PRESENTED. THE RESULTS OF A SERIES OF MODEL SENSITIVITY TESTS UNDER A VARIETY OF PARAMETRIC INPUT CONDITIONS ARE REPORTED.

ONE OF THE APPENDICES CONTAINS THE INFORMATION REQUIRED FOR MODEL APPLICATION AND AS SUCH CONSTITUTES A "USER'S MANUAL." (A) 146P, 17R.

COMMENTS:

THIS IS AN ACTUAL IMPLEMENTATION OF THE MODEL OUTLINED BY J.D. BAKER (1970). THIS PAPER DESCRIBES THE MODEL WHICH, AS IMPLEMENTED, CONTAINS MORE MODELING DETAIL THAN THE ORIGINAL BAKER PAPER, ESPECIALLY WITH RESPECT TO USER BEHAVIOR. WHILE THIS IS THE MOST COMPLEX EXTANT MODEL OF ITS I PE, IT IS STILL CONCEPTUALLY MANAGEABLE. IT ATTEMPTS TO DEAL WITH SEVERAL MESSAGE PROPERTIES (IT IS MODELING AN INTERACTIVE MESSAGE-HANDLING PROCESS), AS WELL AS SUCH FACTORS AS OPERATOR SKILL, STRESS, AND FATIGUE. SUCH MODELS COULD BE USEFUL FOR GAINING INSIGHT INTO MAN-COMPUTER INTERACTION DYNAMICS, AND FOR PARAMETRIC TRADEOFF STUDIES TO DETERMINE BASIC TASK AND SYSTEM PROPERTIES. THEIR USE AT ANY MORE DETAILED LEVEL WILL FIRST REQUIRE VERY EXTENSIVE VALIDATION EFFORTS. THIS MODEL APPEARS TO BE HIGHLY SYSTEM-SPECIFIC. UNTIL THE POTENTIAL BENEFITS OF THIS MODEL ARE DEMONSTRATED, OR MUCH MORE GENERAL-PURPOSE SIMULATION MECHANISMS ARE APPLIED (PERHAPS BASED ON SIMULATION LANGUAGES), OR BOTH, IT SEEMS UNLIKELY THAT THIS APPROACH WILL BE WIDELY USED.

451 INTERACTIVE GRAPHICS

SIMANIS, A. HUMAN FACTORS IN INTERACTIVE COMPUTER GRAPHICS. IN PROCEEDINGS, FOURTH MAN-COMPUTER COMMUNICATIONS CONFERENCE. OTTAWA, ONTARIO, CANADA: NATIONAL RESEARCH COUNCIL OF CANADA, 1975, PP. 8-1 TO 8-12. DESCRIPTION:

HUMAN FACTORS CRITERIA THAT ARE APPLICABLE TO THE DESIGN OF INTERACTIVE COMPUTER GRAPHICS ARE: (1) ICDNIC VS. SEMANTIC CUES; (2) SHORT-TERM MEMORY; (3) MAN VS. MACHINE ALLOCATION OF TASKS; (4) BANDWIDTH OF HUMAN INFORMATION CHANNELS; (5) SPATIAL LAYOUT AND BORDERS; (6) RESPONSE TIME; (7) FEEDBACK; (8) FORGIVENESS AND UNDERSTANDING; AND (9) SECURITY.

THE HUMAN FACTORS ARE BRIEFLY DISCUSSED, USING EXAMPLES FROM "PIERCE", GRAPHICS PACKAGE FOR DATA DISPLAY AND CURVE FITTING, TO SHOW HOW THEY WERE APPLIED TO ITS DESIGN. (A) 11P, 3R.

COMMENTS:

THIS PAPER BRIEFLY DESCRIBES HOW CERTAIN HUMAN FACTORS CRITERIA WERE INCORPORATED INTO THE DESIGN OF AN INTERACTIVE GRAPHICS SYSTEM. ALTHOUGH THE ISSUES DISCUSSED ARE RELEVANT, THE DISCUSSION IS REMARKABLY SIMPLISTIC, AND SOME OF THE RESULTING DESIGN DECISIONS MAY BE CONTROVERSIAL.

452 COMPARISON OF INFORMATION PROCESSING IN HUMAN AND COMPUTER SIMON, H.A., & NEWELL, A. INFORMATION PROCESSING IN COMPUTER AND MAN. AMERICAN SCIENTIST, 1964, 52, 281-300. DESCRIPTION:

IN PROGRAMMING A COMPUTER, IT IS SUBSTANTIALLY IRRELEVANT WHAT PHYSICAL PROCESSES AND DEVICES -- ELECTROMAGNETIC, ELECTRONIC, OR WHAT NOT -- ACCOMPLISM THE MANIPULATIONS. BY THE SAME TOKEN, SINCE THE THINKING HUMAN BEING IS ALSO AN INFORMATION PROCESSOR, IT SHOULD BE POSSIBLE TO STUDY HIS PROCESSES AND THEIR ORGANIZATION INDEPENDENTLY OF THE BIOLOGICAL MECHANISMS -- THE "HARDWARE" -- THAT IMPLEMENT THEM. FINALLY, THERE IS A GROWING BODY OF EVIDENCE THAT THE ELEMENTARY INFORMATION PROCESSES USED BY THE HUMAN BRAIN IN THINKING ARE HIGHLY SIMILAR TO A SUBSET OF THE ELEMENTARY INFORMATION PROCESSES THAT ARE INCORPORATED IN THE INSTRUCTION CODES OF PRESENT-DAY COMPUTERS.

THESE, THEN, ARE THE THREE PROPOSITIONS ON WHICH THIS DISCUSSION RESTS:

(1) A SCIENCE OF INFORMATION PROCESSING CAN BE CONSTRUCTED THAT IS
SUBSTANTIALLY INDEPENDENT OF THE SPECIFIC PROPERTIES OF PARTICULAR
INFORMATION PROCESSING MECHANISMS.

(2) HUMAN THINKING CAN BE EXPLAINED IN INFORMATION-PROCESSING TERMS WITHOUT WAITING FOR A THEORY OF THE UNDERLYING NEUROLOGICAL MECHANISMS.
(3) INFORMATION-PROCESSING THEORIES OF HUMAN THINKING CAN BE FORMULATED IN COMPUTER PROGRAMMING LANGUAGES, AND CAN BE TESTED BY SIMULATING THE PREDICTED BEHAVIOR WITH COMPUTERS. (A, ABBR.) 20P, 20R.

COMMENTS:

THIS PAPER PROVIDES A CLEAR AND CONCISE DISCUSSION OF THE RATIONALE UNDERLYING THE DEVELOPMENT OF AN INFORMATION PROCESSING APPROACH TO PSYCHOLOGY. ALTHOUGH MAN-COMPUTER INTERACTION IS NOT DIRECTLY ADDRESSED, THEORETICAL CONCEPTS THAT ARE RELEVANT TO THIS ISSUE ARE PRESENTED. SPECIFICALLY, THE ASSUMPTION THAT THE INFORMATION PROCESS OF BOTH MEN AND MACHINE ARE VERY SIMILAR HAS OBVIOUS AND SIGNIFICANT IMPLICATIONS FOR THE DESIGN OF INTERACTIVE SYSTEMS. THERE ARE, OF COURSE, THOSE WHO WOULD ARGUE WITH SUCH AN ASSUMPTION.

453 DISPLAYS

SINGLETON, W.T. GENERAL THEORY OF PRESENTATION OF INFORMATION. IN R.K. BERNOTAT, & K.-P. GAERTNER (EDS.), DISPLAYS AND CONTROLS. AMSTERDAM: SWETS & ZEITLINGER, 1972, 75-81. DESCRIPTION:

FROM THE POINT OF VIEW OF THE EXPERIMENTAL PSYCHOLOGIST, DISPLAY DESIGN CAN BE REGARDED AS THE APPLICATION OF PRINCIPLES OF SENSATION AND PERCEPTION. RELEVANT DATA ON VISION AND AUDITION ARE MENTIONED. THE ORGANIZATION OF INCOMING INFORMATION IS AN EVEN MORE COMPLEX PHENOMENON WHICH WARRANTS DETAILED DISCUSSION. QUALITATIVELY, THE RECENT IDEAS OF GIBSON ARE OF PARTICULAR INTEREST WHILE GARNER TAKES A MORE QUANTITATIVE VIEWPOINT. THE CONCEPT OF PERCEPTUAL ACTIVITY AS A SKILL WHICH DEVELOPS WITH EXPERIENCE AND CAN BE MODIFIED BY TRAINING EMPHASIZES THE IMPORTANCE OF FITTING THE MAN TO THE INFORMATION AS A COMPLEMENTARY ACTIVITY TO FITTING THE INFORMATION TO THE MAN. THE CONCEPT OF THE DISPLAY ITSELF AS A COMPONENT OF TRAINING IS DESCRIBED. MORE GENERALLY, IT IS SUGGESTED THAT THERE ARE SEVERE LIMITATIONS IN REGARDING THE HUMAN OPERATOR AS A MECHANISTIC INFORMATION DECODER AND DESTINATION. (A)

COMMENTS:

THIS IS A HIGH-LEVEL DISCUSSION OF SOME OF THE PSYCHOLOGICAL ASPECTS OF DISPLAY DESIGN AND USE. ALTHOUGH THIS IS NOT A COMPREHENSIVE REVIEW, EITHER WITH RESPECT TO THE TOPICS COVERED OR THE DEPTH OF THE DISCUSSIONS, IT DOES PROVIDE AN INTRODUCTION TO SOME OF THE BASIC CONCEPTS INVOLVED IN DISPLAY DESIGN.

454 PSYCHOPHYSIOLOGICAL INPUT METHODS
SLACK, W. COMPUTER-BASED INTERVIEWING SYSTEM DEALING WITH NONVERBAL BEHAVIOR AS WELL AS KEYBOARD RESPONSES. SCIENCE, 1971, 171, 84-87.
DESCRIPTION:

A DIGITAL COMPUTER HAS BEEN PROGRAMMED TO CONDUCT A MEDICAL INTERVIEW WHILE SIMULTANEOUSLY MONITORING THE HEART RATE AND KEYBOARD RESPONSE LATENCY OF THE RESPONDENT FOR EACH QUESTION FRAME. THE PROGRAM CAN BRANCH TO NEW FRAMES CONTINGENT UPON THE HEART RATE AND RESPONSE LATENCY VALUES, AS WELL AS THE KEYBOARD RESPONSES, AND THUS ALTER THE COURSE OF THE INTERVIEW OR THE BASIS OF THIS NONVERBAL INFORMATION. THE PROGRAM IS PRESENTED AS A TECHNIQUE FOR STUDYING THE USE OF NONVERBAL RESPONDENT BEHAVIOR IN AUTOMATED CLINICAL INTERVIEWS. (A)

COMMENTS:

AS THIS PAPER INDICATES, UTILIZATION OF SUCH PSYCHOPHYSIOLOGICAL MEASUREMENTS AS THE HEART RATE AND KEYBOARD RESPONSE LATENCY OF INTERACTIVE SYSTEM USERS IS TECHNOLOGICALLY FEASIBLE. AS THE AUTHOR POINTS DUT, HOWEVER, THE UTILITY OF SUCH MEASURES HAS NOT YET BEEN DEMONSTRATED, EVEN FOR MEDICAL INTERVIEWS. THERE IS ALSO A POTENTIAL INVASION OF PRIVACY ISSUE HERE; EVEN IF USEFUL, SUCH MEASUREMENTS MAY BE HIGHLY CONSTRAINED BY LEGAL AND ETHICAL LIMITATIONS.

455 COMMAND AND CONTROL DISPLAYS
SLAUGHTER, J.B. INTERACTIVE DISPLAYS IN TACTICAL COMMAND AND CONTROL. PAPER
PRESENTED AT WINCON 75, LOS ANGELES, FEBRUARY 1975.
DESCRIPTION:

THE TACTICAL COMMAND AND CONTROL SYSTEM ENVIRONMENT HAS EVOLVED TO THE STATE SUCH THAT FOR ANY NON-TRIVIAL SCENARIO THAT CAN BE POSTULATED BY MISSION ANALYSTS, THE TACTICAL COMMANDER WILL MOST LIKELY BECOME SATURATED BY THE SHEER MAGNITUDE OF THE DATA AND THE OPTIONS WHICH CAN BE MADE AVAILABLE TO HIM. PROVIDING THE TACTICAL COMMANDER WITH THE INFORMATION HE NEEDS IN A FORM WHICH ENHANCES HIS COMPREHENSION AND FACILITATES HIS ABILITY TO MAKE DECISIONS IN A TIMELY AND EFFECTIVE MANNER IS THE MOST IMPORTANT PROBLEM FACING THE COMMAND AND CONTROL SYSTEM ARCHITECT AND DESIGNER.

FORECASTS OF COMMAND AND CONTROL NEEDS OVER THE NEXT DECADE UNANIMOUSLY POINT TO INCREASED RELIANCE ON INTERACTIVE PROCESSING AND DISPLAY TO FACILITATE ON-LINE, REAL-TIME DATA MANAGEMENT AND DISPLAY, DECISION-MAKING, DATA ENTRY AND REDUCTION, SIMULATION, RESOURCE ALLOCATION AND DEPLOYMENT, AND OVERALL FORCE COORDINATION AND MANAGEMENT. THIS PAPER DESCRIBES SOME NEW DIRECTIONS IN DISPLAY TECHNOLOGY WITH A VIEW TOWARD THEIR EXPECTED IMPACT UPON THE DESIGN AND OPERATIONAL CAPABILITY OF TACTICAL COMMAND AND CONTROL SYSTEMS. (A, ABBR.) BP, 12R.

COMMENTS:

THIS PAPER FOCUSES ON DISPLAY FACTORS FOR COMMAND AND CONTROL APPLICATIONS. THE AUTHOR ALSO PROPOSES A LIST OF CRITICAL OPERATIONS IN COMMAND AND CONTROL SITUATIONS. THIS LIST CONSISTS OF SCREENING INCOMING DATA, TRANSFORMING RAW DATA, DATA STORAGE, DISPLAYING DATA, SELECTING AN APPROPRIATE COURSE OF ACTION, AND TRANSMITTING THE PROBLEM SOLVER'S DECISIONS. THIS LIST IS VERY SIMILAR TO THAT PROPOSED BY S. RINGEL (1966). THE PROJECTED REQUIREMENTS OF COMMAND AND CONTROL SYSTEMS PRESENTED IN THIS PAPER ARE REASONABLE AND INDICATE AREAS WHERE ADDITIONAL RESEARCH AND DEVELOPMENT ARE NEEDED.

456 CHANGE OF PROBLEM REPRESENTATION AS AID TO PROBLEM SOLVING SMITH, H.T. MAN-COMPUTER COLLABORATION IN THE DESIGN PROCESS (MEMO NO. 59). SHEFFIELD, ENGLAND: DEPARTMENT OF PSYCHOLOGY, MRC SOCIAL AND APPLIED PSYCHOLOGY UNIT, SEPTEMBER 1974 (ALSO PAPER PRESENTED AT COMPUTER AIDED DESIGN 74, IMPERIAL COLLEGE, SEPTEMBER 1974). DESCRIPTION:

THIS PAPER IS CONCERNED WITH HOW THE APPARENT STRUCTURE OF A PROBLEM-SOLVING PROCEDURE MAY BE ALTERED TO HELP THE USER. AN EXPERIMENT IS PRESENTED THAT INVESTIGATES THE RELATIONSHIP BETWEEN PROBLEM REPRESENTATION AND THE MEMORY LOAD REFLECTED BY THE TYPE OF SEARCH STRATEGY ADOPTED BY INTERACTIVE DESIGNERS. RESOURCE-ALLOCATION PROBLEMS WERE PRESENTED TO SUBJECTS EITHER AS PERT-TYPE NETWORKS OR AS PATTERN REPRESENTATIONS IN WHICH ACTIVITIES ARE DEPICTED AS RECTANGULAR SHAPES. THE RESULTS INDICATE THAT THE PATTERN REPRESENTATION LEADS TO BETTER SOLUTIONS AND THESE SOLUTIONS WERE EASIER TO RECALL AFTER SOLUTION.

#### COMMENTS:

THIS IS A VERY INTERESTING APPROACH TO FACILITATING PROBLEM SOLVING BY REPRESENTING A GIVEN PROBLEM IN AN ENTIRELY DIFFERENT, BUT LOGICALLY ANALOGOUS, FORM AND USING A COMPUTER BOTH TO ASSIST THE PROBLEM SOLVER DIRECTLY AND, BY EXTENSION, TO PERFORM THE MAPPING BETWEEN THE ANALOGOUS FORMS. THERE ARE A NUMBER OF REAL-WORLD (AND LABORATORY) PROPLEMS FOR WHICH ISOMORPHIC FORMS ARE KNOWN, AND THE FORMS OFTEN DIFFER IN CONCEPTUAL SIMPLICITY, SUSCEPTIBILITY TO USEFUL GRAPHICAL EXPRESSION, AND OBVIOUSNESS OF SOLUTION SEARCH STRATEGIES. THIS STUDY PROVIDES AN EMPIRICAL DEMONSTRATION OF ONE SUCH INSTANCE IN WHICH ONE REPRESENTATION, WHICH MAY BE ENTIRELY ARTIFICIAL, IS SUPERIOR TO THE OTHER, WHICH MAY BE THE "CORRECT" EXPRESSION OF THE PROBLEM. IN SUCH INSTANCES, COMPUTER AIDS MAY WELL ALLOW USE OF WHICHEVER PROBLEM REPRESENTATION RESULTS IN THE BEST PROBLEMSOLVING PERFORMANCE. IT IS EVEN CONCEIVABLE THAT TOTAL MATHEMATICAL ISOMORPHISM IS NOT A REQUIREMENT FOR IMPROVED PERFORMANCE. FURTHER RESEARCH IN THIS AREA COULD BE QUITE PRODUCTIVE.

457 AUTOMATED PROBLEM-SOLVING AIDS

SMITH, H.T., & CRABTREE, R.G. INTERACTIVE PLANNING: A STUDY OF COMPUTER AIDING IN THE EXECUTION OF A SIMULATED SCHEDULING TASK. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1975, 7, 213-231.

DESCRIPTION:

THIS PAPER EXAMINES SOME OF THE PROBLEMS AND POSSIBILITIES OF INTERACTIVE DECISION MAKING WITHIN THE EXPERIMENTAL CONTEXT OF AN INDUSTRIAL PROBLEM --PRODUCTION SCHEDULING. AN EXPERIMENT IS DESCRIBED IN WHICH SUPJECTS WERE REQUIRED TO PRODUCE ITEMS FROM, AND GENERALLY CONTROL, A SIMULATED JOB SHOP. A PREDICTIVE FACILITY WAS INTRODUCED INTO THE SIMULATION IN ORDER TO STUDY ITS EFFECT ON SEARCH STRATEGIES AND, IN PARTICULAR, DETERMINE WHETHER THE DECISION HORIZON COULD BE EXTENDED. ONE OF THE MAIN THEMES UNDERLYING THE EXPERIMENT WAS AN INVESTIGATION OF THE EXTENT TO WHICH SUBJECT PROBLEMSOLVING STRATEGIES COULD BE FORMALIZED AND INCORPORATED INTO SOLUTION—SEEKING PROCEDURES.

THE EXPERIMENTAL RESULTS SHOW THAT THE TYPE OF SEARCH WAS RELATIVELY UNAFFECTED BY THE PREDICTIVE FACILITY. AN EXPLANATION OF THIS RESULT AND A DISCUSSION OF THE SUBJECTS' STRATEGIES IS OFFERED IN THE LIGHT OF INFORMATION OBTAINED FROM THE ANALYSIS OF VERBAL PROTOCOL MATERIAL. (A) 19P, 15R.

COMMENTS:

THIS PAPER PRESENTS AN INTERESTING EXAMPLE OF AN AID THAT PROVIDES EXTENDED MEMORY IN A MAN-COMPUTER PROBLEM-SOLVING TASK. A PREDICTIVE FACILITY, WHICH ALLOWED SUBJECTS TO RECALL FORMER STATES OF THE PROBLEM OR OBSERVE FUTURE STATES WITHOUT HAVING TO GENERATE THESE PROBLEM STATES WAS EMPIRICALLLY TESTED. IT WAS OBSERVED THAT THE PREDICTIVE FACILITY DID NOT AFFECT PERFORMANCE SCORES TO A STATISTICALLY SIGNIFICANT EXTENT. THIS MAY WELL BE DUE TO THE SMALL SAMPLE SIZE, HOWEVER, AS SUBJECTS USING THE PREDICTIVE FACILITY ACHIEVED PERFORMANCE SCORES AVERAGING 46% HIGHER THAN THOSE NOT USING THE FACILITY. THE EVIDENCE IS AT LEAST SUGGESTIVE THAT THE AID IS EFFECTIVE.

458 INTERPERSONAL QUERY DIALOGUE
SMITH, J.M. AN ORAL EXPERIMENT ON RETRIEVAL DIALOGUE. PHILADELPHIA,
PENNSYLVANIA: UNIVERSITY OF PENNSYLVANIA, MOORE SCHOOL OF ELECTRICAL
ENGINEERING, JUNE 1967. (NTIS NO. AD 674058)
DESCRIPTION:

AN EXPERIENT IS DESCRIBED FOR DETERMINING THE VOCABULARY AND GRAMMAR OF USER RETRIEVAL REQUESTS IN NATURAL ENGLISH AS A GUIDE IN THE DESIGN OF A LANGUAGE FOR MAN-MACHINE COMMUNICATION THROUGH A TYPEWRITER CONSOLE. RESULTS OF TEN QUISTION-ANSWER DIALOGS ARE DISCUSSED. IN ORAL COMMUNICATION, INITIAL REQUESTS WERE MOST FREQUENTLY DECLARATIVE AND SUBSEQUENTLY BECAME INTERROJATIVE. FEW REQUESTS WERE PHRASED IN COMPLETE ENGLISH SENTENCES. REQUESTS DID NOT PRECISELY STATE THE INFORMATION BEING SOUGHT AND INCLUDED SEQUENCES OF PERIPHERAL COMMENTS. INSTRUCTIONS TO THE SUBJECTS AND THEIR DIALOGS ARE APPENDED. (A) 28P, 5R.

COMMENTS:

THE APPARENT PURPOSE OF THE RESEARCH DESCRIBED HERE AND IN AN ACCOMPANYING PAPER (J.M. SMITH, AUGUST 1967) IS TO INVESTIGATE PRINCIPLES OF HUMAN COMMUNICATION THAT COULD BE USEFUL IN THE DESIGN OF CONVERSATIONAL COMPUTERS. ON THE BASIS OF THE DISCUSSIONS CONTAINED IN THIS PAPER, IT IS DIFFICULT TO EVALUATE THE QUALITY OF THIS EXPERIMENT. THE RESULTS ARE CATEGORIZED IN A VERY GROSS MANNER AND NO SYSTEMATIC ANALYSIS IS PRESENTED. THE FACT THAT SUBJECTS REQUESTS ARE FREQUENTLY UNGRAMMATICAL HAS SERIOUS IMPLICATIONS FOR THE DESIGN OF CONVERSATIONAL SYSTEMS; THESE IMPLICATIONS, HOWEVER, ARE NOT ADEQUATELY TREATED. A MORE RECENT AND THOROUGH DISCUSSION OF THESE IMPLICATIONS HAS BEEN PRESENTED BY A. CHAPANIS (1973). THE READER INTERESTED IN THE STUDY OF INTERPERSONAL DIALOGUE AS A BASIS FOR THE DESIGN OF CONVERSATIONAL SYSTEMS SHOULD CONSULT ANY OF THE SEVERAL ARTICLES ON THIS TOPIC BY A. CHAPANIS AND HIS COLLEAGUES.

459 QUERY DIALOGUE

SMITH, J.M. A WRITTEN EXPERIMENT ON RETRIEVAL DIALOGUE. PHILADELPHIA, PENNSYLVANIA: UNIVERSITY OF PENNSYLVANIA, MOORE SCHOOL OF ELECTRICAL ENGINEERING, AUGUST 1967. (NTIS NO. AD 673900) DESCRIPTION:

AN EXPERIMENT IS DESCRIBED FOR DETERMINING THE VOCABULARY AND GRAMMAR OF USER RETRIEVAL REQUESTS IN ENGLISH AS A GUIDE IN THE DESIGN OF A LANGUAGE FOR MAN-MACHINE COMMUNICATION THROUGH A TYPEWRITER CONSOLE. THIS EXPERIMENT TESTED ARITTEN DIALOG IN FOLLOW-UP TO AN EXPERIMENT THAT TESTED ORAL DIALOG. SUBJECTS REPEATED BEHAVIOR OBSERVED IN ORAL DIALOG OF DISREGARDING INSTRUCTIONS AND PHRASING QUERIES IN NON-SENTENTIAL MESSAGES, AND MAY REFLECT THE SUBJECT'S ASSUMPTIONS ABOUT HIS STATUS RELATIVE TO THE SYSTEM. WRITTEN LANGUAGE STRUCTURES WERE MORE PRECISE THAN THOSE USED IN ORAL COMMUNICATION. INSTRUCTIONS TO THE SUBJECTS, THEIR DIALOGS, AND DIALOG REQUESTS GROUPED BY STATEMENT TYPE (DECLARATIVE, IMPERATIVE, AND INTERROGATIVE) ARE APPENDED. THE TEN SUBJECTS INCLUDED HIGH SCHOOL STUDENTS, GRADUATE STUDENTS, A LIBRARIAN, AND A PROFESSOR. (A) 55P, 1R.

COMMENTS:

THIS EXPERIMENT IS A FOLLOW-UP TO THAT REPORTED BY J.M. SMITH (JUNE 1967).

ON THE BASIS OF THE EXPERIMENTAL PROTOCOLS PRESENTED IN AN APPENDIX, THIS

EXPERIMENT WAS NOT CONDUCTED IN A CAREFULLY CONTROLLED MANNER. APPARENT

INCONSISTENCIES IN THE EXPERIMENTAL CONDUCT FROM SUBJECT TO SUBJECT GREATLY

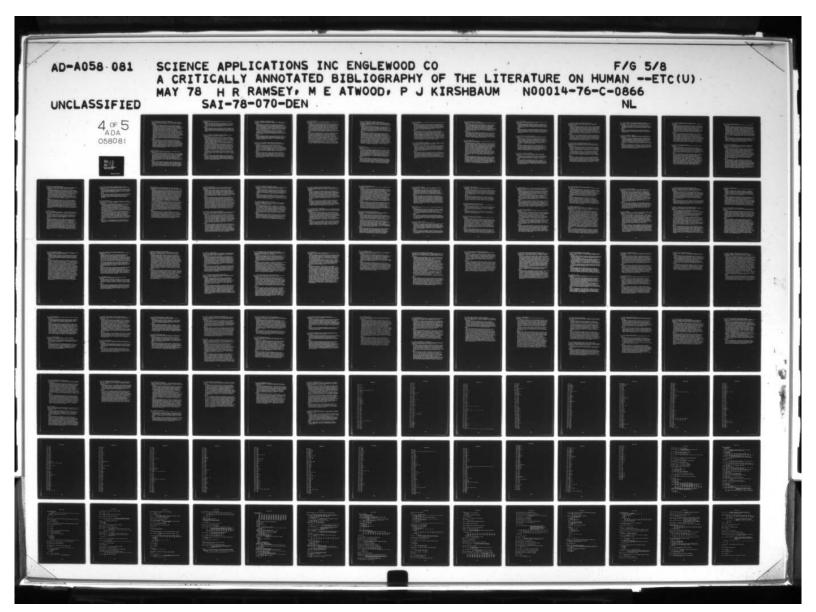
REDUCE THE USEFULNESS OF THE REPORTED RESULTS.

460 COMPARISON OF NORMAL BATCH PROCESSING WITH FAST TURNAROUND SMITH, L.B. A COMPARISON OF BATCH PROCESSING AND INSTANT TURNAROUND. COMMUNICATIONS OF THE ACM, 1967, 10, 495-500. DESCRIPTION:

A STUDY OF THE PROGRAMMING EFFORTS OF STUDENTS IN AN INTRODUCTORY PROGRAMMING COURSE IS PRESENTED AND THE EFFECTS OF HAVING INSTANT TURNAROUND (A FEW MINUTES) AS OPPOSED TO CONVENTIONAL BATCH PROCESSING WITH TURNAROUND TIMES OF A FEW HOURS ARE EXAMINED. AMONG THE ITEMS COMPARED ARE THE NUMBER OF COMPUTER RUNS PER TRIP TO THE COMPUTATION CENTER, PROGRAM PREPARATION\* TIME, KEYPUNCHING TIME, DEBUGGING TIME, NUMBER OF RUNS, AND ELAPSED TIME FROM THE FIRST RUN TO THE LAST RUN ON EACH PROBLEM. EVEN THOUGH THE RESULTS ARE INFLUENCED BY THE FACT THAT "BONUS POINTS" WERE GIVEN FOR COMPLETION OF A PROGRAMMING PROBLEM IN LESS THAN A SPECIFIED NUMBER OF RUNS, THERE IS EVIDENCE TO SUPPORT "INSTANT" OVER "BATCH". (A)

COMMENTS:

THIS STUDY IS AN ATTEMPT TO DETERMINE THE EFFECT OF TURNAROUND TIME ON PROGRAM DEVELOPMENT ACTIVITIES, WITHOUT ALSO INTRODUCING BASIC DIFFERENCES IN METHOD OF SUBMISSION (E.G., TIME-SHARING, WITH DISC FILES, ON-LINE TERMINALS, ETC., VS. CARD-ORIENTED BATCH SUBMITTAL). IN THIS STUDY, ALL SUBMISSIONS USED CARDS AND WERE PROCESSED IN ESSENTIALLY THE SAME WAY, BUT "INSTANT" RUNS WERE RETURNED WITHIN A FEW MINUTES, WHILE NORMAL "BATCH" RUNS TOOK UP TO SEVERAL HOURS. EACH SUBJECT SOLVED SOME PROBLEMS IN EACH CONDITION, WITH ORDER OF PRESENTATION COUNTERBALANCED ACROSS SUBJECTS. THE "INSTANT" CONDITION RESULTED IN SLIGHT INCREASES IN REPORTED PREPARATION, KEYPUNCHING, AND DEBUGGING TIME AND IN NUMBER OF RUNS, BUT RESULTED IN A 19% LOWER SPAN TIME TO COMPLETION THAN THE "BATCH" CONDITION. IT IS LIKELY THAT DIFFERENCES BETWEEN THE CONDITIONS WERE REDUCED BY INSTRUCTIONS TO MINIMIZE THE NUMBER OF RUNS ("BONUS POINTS" WERE AAARDED) AND BY AN OVERLAP IN TURNAROUND TIME BETWEEN THE TWO CONDITIONS ("BATCH" TURNAROUND TIME ACTUALLY VARIED FROM A FEW MINUTES TO MANY HOURS). IT IS ALSO POSSIBLE THAT DIFFERENT SOLUTION STRATEGIES ARE EMPLOYED BY EXPERIENCED PROGRAMMERS, AND ON LARGE PROGRAMMING EFFORTS, THAN BY THESE BEGINNERS. IT IS IMPORTANT TO RECOGNIZE THAT THE "INSTANT BATCH" CONDITION USED HERE IS QUALITATIVELY DIFFERENT FROM THE USE OF INTERACTIVE SYSTEMS IN TERMS OF ITS PROMOTION OF "CONTINUITY OF THOUGHT" (CF. R.B. MILLER, 1968).



461 GEOGRAPHIC DISPLAYS FOR TACTICAL WEAPON SYSTEM SMITH, R.L., MOE, G.L., & KLEIN, G.G. DEVELOPMENT OF GRAPHIC AREA DISPLAYS FOR ASM ATTACK MANAGEMENT SIMULATION (2 VOLS.) (TECHNICAL REPORT C-1003). BURBANK, CALIFORNIA: OCEAN TECHNOLOGY, INC., 1972. (NTIS NOS. AD 747708 AND AD 747691)

DESCRIPTION: EXPERIMENTAL TECHNIQUES ARE DEVELOPED IN THE FIRST PHASE OF RESEARCH DIRECTED TO COMPARATIVE EVALUATION OF THE EFFECTIVENESS OF MAN/DISPLAY SYSTEM CONCEPTS. THE OBJECTIVE IS TO INVESTIGATE TRENDS IN MAN/DISPLAY EFECTIVENESS ATTRIBUTABLE TO DIFFERENT LEVELS OF INFORMATION INTEGRATION AND DATA PROCESSING. A NAVY TACTICAL DISPLAY ASSOCIATED WITH SURFACE SHIP ANTI-SUBMARINE ATTACK CONTROL IS INVESTIGATED. THE LEVELS OF INFORMATION INTEGRATION ARE REPRESENTED BY AN OPERATIONAL DISPLAY SYSTEM, A DEVELOPMENTAL DISPLAY SYSTEM AND AN ADVANCED DISPLAY CONCEPT. EXPERIMENTAL TECHNIQUE CHOSEN EMPLOYS A LABORATORY SIMULATION OF THE DISPLAY SYSTEMS OPERATED IN A SIMULATED TACTICAL AND SENSOR ENVIRONMENT BY SUBJECT THE FIRST PHASE OF THE RESEARCH HAS INCLUDED: DEFINITION OF OPERATORS. DISPLAY FORMATS AND CONTROLS FOR A MULTI-MODE LABORATORY DISPLAY CONSOLE; DEVELOPMENT OF SOFTWARE FOR THE DISPLAY CONSOLE COMPUTER; DESIGN OF A PILOT EXPERIMENT FOR VERIFYING TECHNIQUES; DEFINITION OF MAN/DISPLAY EFFECTIVENESS MEASURES; DETERMINATION OF LABORATORY PROCEDURES; DEVELOPMENT OF AN OPERATOR TRAINING MANUAL; AN EVALUATION OF SIMULATION SOFTWARE AND EXPERIMENTAL PROCEDURES. THE RESEARCH PLANNED FOR THE SECOND PHASE WILL INCLUDE: CONDUCTING A PILOT EXPERIMENT; CORRECTING SOFTWARE AND PROCEDURAL DEFICIENCIES; DESIGN OF THE PRINCIPAL EXPERIMENT; CONDUCTING THE PRINCIPAL EXPERIMENT; EXPERIMENT DATA ANALYSIS AND COMPAPITIVE SYSTEM EVALUATION. (A) 355P, OR.

COMMENTS:

THIS PAPER DESCRIBES THE "AREA MATCHING ATTACK CONTROL" CONCEPT FOR A TACTICAL DISPLAY. BRIEFLY, THIS DISPLAY PRESENTS ONE SHAPE OUTLINE TO INDICATE THE GEOGRAPHIC AREA WHERE A TARGET MIGHT BE AND A SECOND OUTLINE TO INDICATE A WEAPON'S COVERAGE AREA. AN IMMEDIATE, BUT CORRECTABLE, PROBLEM WITH THIS CONCEPT IS THAT BOTH OUTLINES ARE PRESENTED SIMULTANEOUSLY BUT NEITHER IS LABELLED AS TO WHICH IS WHICH. THIS DISPLAY CONCEPT WOULD BE OF INTEREST TO THOSE CONCERNED WITH TACTICAL DISPLAYS. THE RATHER EXTENSIVE DISCUSSIONS OF PROPOSED EXPERIMENTS INDICATE NUMEROUS METHODOLOGICAL AND PROCEDURAL ERRORS THAT WOULD PREVENT AN ADEQUATE EVALUATION OF THIS DISPLAY AND SHOULD PROBABLY BE SKIPPED BY MOST READERS. VOLUME II CONTAINS PROGRAM LISTINGS OF THE PROGRAMS DEVELOPED TO SIMULATE THE DISPLAYS IN AN ANTISUBMARINE WARFARE ENVIRONMENT.

462 COLOR CODING

SMITH, S.L. COLOR CODING AND VISUAL SEPARABILITY IN INFORMATION DISPLAYS. JOURNAL OF APPLIED PSYCHOLOGY, 1963, 47, 358-364. DESCRIPTION:

TWELVE EXPERIMENTAL SUBJECTS PERFORMED BOTH VISUAL SEARCH AND CLASS COUNTING TASKS, VIEWING DISPLAYS CONTAINING 20, 60, OR 100 ITEMS. EACH ITEM CONSISTED OF A VECTOR, LETTER, AND 3-DIGIT NUMBER GROUPED TOGETHER, AND WAS PRESENTED AS WHITE-ON-BLACK IN SOME DISPLAYS, OR IN 1 OF 5 COLORS. THE COLOR CODE WAS REDUNDANT WITH THE 5 CLASS-DESIGNATOR LETTERS WHAT WERE USED. AVERAGE SEARCH AND COUNTING TIME, AND COUNTING ERRORS, INCREASED WITH INCREASING DISPLAY DENSITY (NUMBER OF ITEMS). NONE OF THESE MEASURES VARIED SIGNIFICANTLY AMONG THE 5 DIFFERENT TARGET CLASSES (COLORS). ADDITION OF THE REDUNDANT COLOR CODE RESULTED IN AN AVERAGE TIME REDUCTION OF 65% IN THE VISUAL SEARCH TASK AND 69% IN THE COUNTING TASK, WITH A REDUCTION OF 76% IN COUNTING ERRORS. (A) 7P, 6R.

COMMENTS:

THIS IS A CAREFULLY CONDUCTED EXPERIMENTAL STUDY THAT INDICATES THAT COLOR CODING SIGNIFICANTLY IMPROVES PERFORMANCE IN BOTH VISUAL SEARCH AND CLASS COUNTING TASKS. SEARCH TIME, COUNTING TIME, AND COUNTING ERRORS ARE ALL RELATED TO DISPLAY DENSITY, AND WERE REDUCED, IN A FAIRLY CONSISTENT MANNER, BY COLOR CODING. NO SIGNIFICANT DIFFERENCES DUE TO THE SPECIFIC COLOR USED IN COLOR CODING WERE FOUND. HOWEVER, AS THE AUTHOR INDICATES, THIS MAY BE DUE TO A FLAW IN THE EXPERIMENTAL DESIGN (CF. S.L. SMITH, & D.W. THOMAS, 1964).

463 COLOR CODING

SMITH, S.L. COLOR-CODED DISPLAYS FOR DATA-PROCESSING SYSTEMS. ELECTRO-TECHNOLOGY, APRIL 1963, 71(4), 63-69.

RESULTS OF EXPERIMENTAL STUDIES CONFIRM THE POTENTIAL VALUE OF DISPLAY COLOR-CODING IN IMPROVING HUMAN OPERATOR PERFORMANCE. DATA ARE PRESENTED ON THE INFLUENCE OF COLOR IN VISUAL SEARCH AND COUNTING TASKS, THE LEGIBILITY OF SYMBOLS, AND THE DISCRIMINABILITY OF DATA CLASSES -- ALL BASIC TO ANY DISPLAY DESIGN APPLICATIONS. (A) 7P, 2R.

COMMENTS:

THIS PAPER DESCRIBES A SERIES OF FOUR CAREFULLY EXECUTED EXPERIMENTS THAT INDICATE THE RELATIVE VALUE OF COLOR CODING IN SEARCH AND COUNTING TASKS. VARIABLES CONSIDERED INCLUDE OVERPRINTED SYMBOLS, DISPLAY DENSITY, SHAPE CODING, AND NUMBER OF COLORS SIMULTANEOUSLY USED IN CODING. MORE DETAILED INFORMATION MAY BE FOUND IN THE REPORTS OF INDIVIDUAL EXPERIMENTS BY THIS AUTHOR.

464 DISPLAY LEGIBILITY WITH OVERLAPPING COLOR-CODED SYMBOLS
SMITH, S.L. LEGIBILITY OF OVERPRINTED SYMBOLS IN MULTICOLORED DISPLAYS.
JOURNAL OF ENGINEERING PSYCHOLOGY, 1963, 2, 82-96.
DESCRIPTION:

SIX EXPERIMENTAL SUBJECTS VIEWED A SERIES OF DISPLAYS OF OVERPRINTED COLORED NUMBERS, AND IN EACH CASE COUNTED THE OCCURRENCES OF A PARTICULAR TARGET DIGIT WHICH VARIED FROM TRIAL TO TRIAL. FIVE DEGREES OF SYMBOL OVERPRINTING WERE USED, FOR DISPLAYS REPRESENTING EACH OF THE 15 POSSIBLE PAIRINGS OF FIVE SYMBOL COLORS. COUNTING TIME AND ERRORS WERE INTERPRETED AS INVERSE MEASURES OF SYMBOL LEGIBILITY.

LEGIBILITY DECREASED REGULARLY AS DEGREE OF SYMBOL OVERPRINTING WAS INCREASED: COMPARED WITH CONDITIONS OF NO OVERPRINTING, TRIALS WITH FULL SYMBOL OVERLAP REQUIRED TWICE AS MUCH COUNTING TIME AND RESULTED IN FIVE TIMES AS MANY COUNTING ERRORS.

THE OVERALL LEGIBILITY OF SYMBOLS WAS NOT GREATLY INFLUENCED BY THE PARTICULAR PAIR OF COLORS INVOLVED IN THE OVERPRINTING, WHEN TARGETS OF BOTH COLORS HAD TO BE COUNTED. HOWEVER, WHEN TARGETS OF JUST ONE COLOR WERE COUNTED, A CLEARLY DEFINED ORDERING OF THE COLORS IN TERMS OF THEIR VISUAL DOMINANCE WAS APPARENT. WHITE NUMBERS WERE THE MOST LEGIBLE UNDER THESE CONDITIONS, FOLLOWED BY ORANGE, RED, GREEN, AND BLUE NUMBERS, IN THAT ORDER. UNDER CONDITIONS OF FULL OVERPRINTING, ONLY 1% OF TRIALS INVOLVING WHITE TARGETS WERE IN ERROR, WHEREAS THE CORRESPONDING ERROR FREQUENCY FOR BLUE TARGETS WAS 50% ALTHOUGH COUNTING TIME WAS FOUR TIMES AS GREAT.

INCIDENTAL DIFFERENCES IN LEGIBILITY WERE NOTED AMONG THE PARTICULAR NUMBER SYMBOLS USED. THESE DIFFERENCES WERE SMALL IN COMPARISON TO THOSE ATTRIBUTABLE TO THE DIFFERENT COLORS, SUGGESTING THAT IN THIS STUDY COLOR WAS MORE INFLUENTIAL THAN SHAPE IN DETERMINING THE LEGIBILITY OF OVERPRINTED SYMBOLOGY. (A)

15P, 9R. COMMENTS:

THIS IS A RELATIVELY STRAIGHTFORWARD EXPERIMENT. THE FACT THAT COUNTING PERFORMANCE DECREASES AS THE AMOUNT OF SYMBOL OVERLAP INCREASES IS NOT SURPRISING. THIS PAPER GOES ONE STEP FURTHER, HOWEVER, BY PROVIDING DATA WHICH MIGHT BE USED TO OPTIMIZE COLOR ALLOCATION UNDER SUCH CIRCUMSTANCES. THE SUGGESTION THAT DIFFERENT NUMBER SYMBOLS HAVE DIFFERENT LEGIBILITY IS EXTENDED BY S.L. SMITH AND D.W. THOMAS (1964), WHO DEMONSTRATE SIGNIFICANT EFFECTS DUE TO SYMBOLS AND SHAPE CODES.

465 GENERAL DISCUSSION OF MAN-COMPUTER DIALOGUE
SMITH, S.L. MAN-COMPUTER INFORMATION TRANSFER. IN J.H. HOWARD, (ED.),
ELECTRONIC INFORMATION DISPLAY SYSTEMS. WASHINGTON, D.C.: SPARTAN BOOKS, 1963,
284-299.

DESCRIPTION:

CURRENT ADVANCES IN THE TECHNOLOGY OF AUTOMATED DATA PROCESSING FORCE US
TO GIVE INCREASING ATTENTION TO THE PROBLEMS AND POTENTIALITIES OF MANCOMPUTER INTERACTION. IN THE CONTEXT OF INFORMATION SYSTEM DESIGN,
COMPUTERS CAN BE RELIED UPON FOR FAST, ACCURATE PROCESSING OF DATA PERTINENT
TO A SPECIFIED ENVIRONMENT. HUMAN OPERATORS ARE CUSTOMARILY EXPECTED TO
SPECIFY THIS ENVIRONMENT OF INTEREST, ESTABLISH CRITERIA FOR DATA RELEVANCE,
GUIDE AND INTERPRET THE RESULTS OF DATA PROCESSING, AND INITIATE ACTIONS
INTENDED TO CHANGE THE ENVIRONMENT, TO IMPROVE IT IN THE LIGHT OF HUMAN
VALUES, GOALS AND MOTIVES.

THESE ROLES OF MAN AND COMPUTER ARE POTENTIALLY COMPLEMENTARY. A JOINT ALLOCATION OF TASKS TO MEN AND COMPUTERS MUST TAKE INTO ACCOUNT THEIR DISPARATE ABILITIES IN ESTABLISHING THEIR PARTICULAR INFORMATION REQUIREMENTS. AND TO INSURE EFFECTIVE INTERACTION BETWEEN MAN AND COMPUTER IT IS NECESSARY TO PROVIDE MEANS OF INFORMATION TRANSFER, IN A VARIETY OF FORMS. (A, ABBR.)

COMMENTS:

THIS PAPER PRESENTS AN ABSTRACT, VERY HIGH LEVEL MODEL OF MAN-COMPUTER INFORMATION TRANSFER AND BRIEFLY COMMENTS ON VARIOUS ASPECTS OF THIS MODEL. THE TOPICS CONSIDERED INCLUDE SYSTEM DESIGN, DISPLAY HARDWARE, HUMAN INFORMATION PROCESSING ABILITIES, TASK ANALYSIS, PROGRAMMED LEARNING, AND THE DYNAMICS OF MAN-COMPUTER INTERACTION. THESE TOPICS, AND OTHERS, ARE DISCUSSED VERY SRIEFLY.

466 GUIDELINES FOR MAN-COMPUTER INTERACTION IN COMMUNICATION SYSTEM SMITH, S.L. AN ON-LINE MODEL OF TRAFFIC CONTROL IN A COMMUNICATION NETWORK (TECHNICAL REPORT MTR-2813). BEDFORD, MASSACHUSETTS: MITRE CORP., 1974. DESCRIPTION:

AN ON-LINE INTERACTIVE MODEL OF THE TRAFFIC CONTROL FUNCTIONS OF A COMMUNICATION SYSTEM CONTROL ELEMENT (CSCE) HAS BEEN DESIGNED AND IMPLEMENTED USING PROCESSOR-AIDED DISPLAY STATIONS IN THE MITRE PADS LABORATORY. THIS MODEL HAS BEEN USED TO INVESTIGATE AND DEMONSTRATE DESIGN CONCEPTS AND FUNCTIONAL CAPABILITIES OF THE CSCE, WHICH IS AN IMPORTANT COMPONENT OF THE TACTICAL COMMUNICATIONS CONTROL FACILITIES BEING DEVELOPED UNDER THE TRI-TAC PROGRAM. THIS REPORT DESCRIBES THE CSCE MODEL, EMPHASIZING FEATURES RELATING TO ITS MAN-COMPUTER INTERFACE. DESIGN GUIDELINES ARE PROPOSED FOR INTERACTIVE TASK SEQUENCES COMPRISING THE CSCE MODEL. (A) 51P, 8R.

COMMENTS:

THIS PAPER CONTAINS A FAIRLY DETAILED DISCUSSION OF THE COMMUNICATION SYSTEM CONTROL ELEMENT MODEL. OF MORE GENERAL INTEREST, HOWEVER, ARE THE DISCUSSIONS OF THE USER-SYSTEM INTERFACE AND A COLLECTION OF GUIDELINES FOR INTERFACE DESIGN. ALTHOUGH NO ATTEMPT IS MADE TO VALIDATE THESE GUIDELINES, THEY APPEAR TO BE REASONABLE AND THEY ARE CLEARLY ILLUSTRATED IN THE SPECIFIC SYSTEM DISCUSSED IN THIS PAPER. THIS PAPER CONTAINS SEVERAL IDEAS THAT WOULD BE USEFUL TO THOSE CONCERNED WITH THE DESIGN OF INTERACTIVE SYSTEMS.

467 LARGE-SCREEN DISPLAYS

SMITH, S.L., & DUGGAR, B.C. DO LARGE SHARED DISPLAYS FACILITATE GROUP EFFORT? HUMAN FACTORS, 1965, 7, 237-244. (NTIS NO. AD 633262)
DESCRIPTION:

TWELVE FOUR-MAN GROUPS SEARCHED AND COUNTED VISUALLY DISPLAYED ITEMS. IN ONE SESSION, THEY USED A LARGE DISPLAY SHARED IN COMMON BY THE GROUP MEMBERS; IN ANOTHER SESSION, SEPARATE SMALLER DISPLAYS WERE VIEWED INDIVIDUALLY. INFORMATION WAS PRESENTED UNDER CONDITIONS OF ECUAL VISUAL ANGLE, SO THAT THESE TWO DISPLAY MODES WERE LOGICALLY EQUIVALENT. PERFORMANCE WAS 15 PERCENT FASTER WITH THE LARGE GROUP DISPLAY THAN WITH THE SMALL INDIVIDUAL DISPLAYS. THERE WAS NO SIGNIFICANT DIFFERENCE IN ERROR FREQUENCY. SOME SUBJECTS PREFERRED THE LARGE DISPLAY, SOME THE SMALL. IN A SUPPLEMENTARY STUDY, RUNNING INDIVIDUAL SUBJECTS RATHER THAN GROUPS, THERE WERE NO DIFFERENCES IN SPEED OR ACCURACY BETWEEN THE DISPLAY MODES. THIS SUGGESTS THAT THE DIFFERENCE IN GROUP PERFORMANCE TIME RESULTED FROM SOME FACILITATING EFFECT OF THE SHARED DISPLAY ON THE PROCESS OF GROUP INTERACTION. (A) BP. SR.

BP, 5R. COMMENTS:

THIS IS A SIMPLE, STRAIGHTFORWARD PAIR OF EXPERIMENTS DEMONSTRATING THAT A LARGE, SHARED DISPLAY WAS SOMEWHAT MORE EFFECTIVE FOR A GROUP VISUAL-SEARCH TASK THAN WERE INDIVIDUAL DISPLAYS. THE CONTROL EXPERIMENT USING INDIVIDUALS, RATHER THAN GROUPS, SHOULD PROVIDE ADEQUATE CONTROL FOR DIFFERENCES IN VISUAL PROPERTIES BETWEEN THE DISPLAYS. THE CONCLUSION, THAT GROUP COOPERATION WAS FACILITATED BY THE SHARED DISPLAY, APPEARS WELL FOUNDED. IT SHOULD BE KEPT IN MIND, HOWEVER, THAT THIS RESULT MAY NOT GENERALIZE TO ALL KINDS OF TASKS OR INFORMATION SYSTEM DISPLAYS. THIS WAS A VISUAL SEARCH TASK, AND UNANIMOUS AGREEMENT OF THE TEAM MEMBERS WAS REQUIRED BEFORE A TRIAL COULD BE COMPLETED. AS A RESULT, THE SUBJECTS APPARENTLY TENDED TO VERIFY THE PRESENCE OF A TARGET IN THE INDICATED POSITION ON THEIR DISPLAYS. IN THE INDIVIDUAL DISPLAY CONDITION, COMMUNICATION OF LOCATIONS WAS UNDOUBTEDLY MORE DIFFICULT. IT IS ALSO NOT COMPLETELY CLEAR THAT THE EXPERIMENTERS WERE ABLE TO FULLY ALLEVIATE THE SUBJECTS' SUSPICION THAT THEIR DISPLAYS MIGHT CONTAIN DIFFERENT INFORMATION. THE RESULT MAY, THEREFORE, BE SOMEWHAT SPECIFIC TO THE PARTICULAR EXPERIMENTAL TASK CHOSEN.

468 HUMAN FACTORS PROBLEMS IN AUTOMATED SPEECH GENERATION
SMITH, S.L., & GOODWIN, N.C. CGMPUTER-GENERATED SPEECH AND MAN-COMPUTER
INTERACTION. HUMAN FACTORS, 1970, 12, 215-223 (ALSO IN PROCEEDINGS OF THE
INTERNATIONAL SYMPOSIUM ON MAN-MACHINE SYSTEMS, 8-12 SEPTEMBER 1969 (VOL. 1),
IEEE CONFERENCE RECORD NO. 69C58-4MS, NEW YORK: INSTITUTE OF ELECTRICAL AND
ELECTRONICS ENGINEERS, 1969).
DESCRIPTION:

LARGE-SCALE USE OF TALKING COMPUTERS MAY BE ANTICIPATED FOR REASONS OF GENERAL CONVENIENCE AND SPECIAL EFFECTIVENESS. A TELEPHONE LINK TO A COMPUTER, WITH TOUCH-TONE INPUTS AND STORED SPEECH OUTPUTS, POSES A NUMBER OF DESIGN PROBLEMS OF INTEREST FOR THE HUMAN FACTORS SPECIALIST. RECOMMENDED FEATURES INCLUDE (1) USER PACING AND OPTIONAL REPETITION OF SPEECH OUTPUT IN A TRANSACTIONAL SEQUENCE, (2) USE OF DIFFERENT VOICES AND OTHER AUDITORY CODING TO DISTINGUISH TYPES OF OUTPUT, AND (3) USE OF TONE CODES TO INDICATE REQUIRED INPUT. (A)

COMMENTS:

THE AUTHORS DESCRIBE A PROTOTYPE SPEECH GENERATION SYSTEM AND PRESENT A HYPOTHETICAL EXAMPLE OF HOW SUCH A SYSTEM COULD BE USED AS AN AID TO MEDICAL DIAGNOSIS. SEVERAL HUMAN FACTORS ISSUES AR RAISED AND THE ADVANTAGES AND DISADVANTAGES OF COMPUTER-GENERATED SPEECH FOR MAN-COMPUTER INTERACTION ARE FAIRLY TREATED. PERHAPS UNDERSTATED, HOWEVER, ARE THE LIMITATIONS OF THE TELEPHONE AS A COMPUTER TERMINAL. THE LACK OF FEEDBACK WOULD MAKE THE INPUT OF LONG NUMERIC SEQUENCES DIFFICULT, ENTERING ALPHABETIC MATERIAL WOULD BE EXTREMELY DIFFICULT, AND THE RELATIVELY SMALL NUMBER OF KEYS AVAILABLE DOESN'T PERMIT THE USE OF PROGRAMMABLE FUNCTION KEYS. THE AUTHORS POINT OUT THAT ONE LIMITATION OF AUDITORY DISPLAYS IS THAT THEY DO NOT PERMIT THE SIMULTANEOUS DISPLAY OF MULTIPLE ALTERNATIVES. THIS SUGGESTS THE NEED TO CAREFULLY CONSIDER THE TASK DOMAINS IN WHICH COMPUTER-GENERATED SPEECH WOULD BE APPROPRIATE. A SIMILAR PAPER, CONCERNING COMPUTER VOICE ANSWER-BACK IN A BLOOD BANK INVENTORY SETTING, HAS BEEN PRESENTED BY J.F. WILDE AND B. SIEGEL (1970). A FAIRLY THOROUGH REVIEW OF THE PROBLEMS AND POSSIBILITIES OF BOTH SPEECH GENERATION AND SPEECH PRODUCTION IS PRESENTED IN R. TURN (1974).

469 BLINK CODING

SMITH, S.L., & GOODWIN, N.C. BLINK CODING FOR INFORMATION DISPLAY. HUMAN FACTORS, 1971, 13, 283-290.

DESCRIPTION:

TEN MEN SCANNED CATHODE-RAY-TUBE DISPLAYS TO SEARCH FOR DESIGNATED TARGET ITEMS. SEARCH TIME INCREASED WITH INCREASING DISPLAY DENSITY AND WAS 50% FASTER WHEN A 3-CPS BLINK WAS IMPOSED ON ITEMS OF THE TARGET CLASS. THE BLINKING OF NONTARGET ITEMS WAS ALMOST EQUALLY EFFECTIVE, INDICATING THAT BLINK CAN BE USED EITHER AS AN INCLUSION OR EXCLUSION CODE. IN COMPARISON WITH STEADY, NONBLINKING DISPLAYS, SEARCH TIME WAS NOT SIGNIFICANTLY DIFFERENT FOR DISPLAYS IN WHICH ALL ITEMS BLINKED, OR IN WHICH A RANDOM SELECTION OF ITEMS BLINKED. IT IS CONCLUDED THAT FOR VISUAL SEARCH TASKS OF THE KIND REPORTED HERE, THERE IS NO MARKED DELETERIOUS EFFECT OF BLINK CODING ON SYMBOL LEGIBILITY, AND NO MARKED INTERFERENCE ATTRIBUTABLE TO IRRELEVANT BLINK. (A)

8P, 21R.

THIS IS A STRAIGHTFORWARD, WELL EXECUTED EXPERIMENTAL STUDY WHICH CONCLUDES THAT RELEVANT BLINK CODING CAN CONSIDERABLY AID PERFORMANCE IN A VISUAL SEARCH TASK USING A CRT DISPLAY. ALTHOUGH BLINK CODING HELPED PERFORMANCE EVEN WITH RELATIVELY LOW DISPLAY DENSITY, PERFORMANCE IMPROVEMENT INCREASED RAPIDLY AS DISPLAY DENSITY INCREASED. ALTHOUGH THE PRESENT PAPER ASSERTS THAT IRRELEVANT BLINKING HAD LITTLE DELETERIOUS EFFECT, SEE THE AUTHORS LATER PAPER (SMITH, S.L., & GOODWIN, N.C., 1972) FOR SOME QUALIFICATIONS.

470 BLINK CODING

SMITH, S.L., & GOODWIN, N.C. ANOTHER LOOK AT BLINKING DISPLAYS. HUMAN FACTORS, 1972, 14, 345-347.

DESCRIPTION:

TWELVE SUBJECTS SCANNED DISPLAYED PROSE PASSAGES TO DETECT RANDOMLY INSERTED LETTER SUBSTITUTION ERRORS. IN COMPARISON WITH STEADY DISPLAYS, THIS CHECK-READING TASK WAS PERFORMED 10% MORE SLOWLY BUT WITH EQUAL ACCURACY WHEN THE DISPLAYED MATERIAL BLINKED AT A 3-HZ RATE. ALTHOUGH THE POTENTIAL VALUE OF BLINK CODING CONFIRMED IN PREVIOUS RESEARCH IS NOT QUESTIONED, THE REDUCTION IN READABILITY OF BLINKING DISPLAYS DEMONSTRATED IN THE PRESENT STUDY SUGGESTS THAT SOME PRECAUTIONS MUST BE TAKEN IN THE PRACTICAL APPLICATION OF THIS DISPLAY CODING TECHNIQUE. (A)

3P, 2R.

IN A PREVIOUS STUDY (SMITH, S.L., & GOODWIN, N.C., 1971), THE AUTHORS DETECTED NO SIGNIFICANT DELETERIOUS EFFECTS OF IRRELEVANT BLINKING IN A VISUAL SEARCH TASK. HERE THE AUTHORS PROVIDE FURTHER CLARIFICATION OF THEIR PREVIOUS CONCLUSIONS. THIS NOTE IS AN INCOMPLETE REPORT OF A LARGER EXPERIMENT, AND REPORTS ONLY INFORMATION RELEVANT TO BLINK CODING. SINCE IRRELEVANT BLINKING HAD NO DELETERIOUS EFFECTS ON A VISUAL SEARCH TASK, BUT DID IMPAIR PERFORMANCE ON A CHECK-READING TASK, THE PROPERTIES OF THE VISUAL TASK MUST BE CONSIDERED WHEN BLINK CODING IS USED. THE AUTHORS SUGGEST THAT THE RELEVANT FACTOR IS THE ABILITY OF THE SUBJECT TO ADJUST HIS SCAN RATE TO MATCH THE BLINK RATE; THIS MAY BE MORE EASILY DONE IN THE PREVIOUS VISUAL SEARCH TASK THAN IN THE PRESENT CHECK-READING TASK. PRESUMABLY, IF ONE KNEW THE TEMPORAL PROPERTIES OF THE SUBJECTS' SCANNING STRATEGY, THE BLINK RATE MIGHT BE SET ACCORDINGLY, IF WITHIN USEFUL BLINK RATE LIMITS.

471 EVALUATING LEGIBILITY OF DISPLAYS

SMITH, S.L., & GOODWIN, N.C. CHECK-READING AS A MEASURE OF DISPLAY LEGIBILITY. IN PROCEEDINGS OF THE 17TH ANNUAL MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1973, 21-24.
DESCRIPTION:

CHECK-READING DISPLAYED PROSE MATERIAL TO DETECT RANDOM LETTER SUBSTITUTION ERRORS IS PROPOSED AS A FAST, EFFICIENT PROCEDURE FOR ASSESSING DISPLAY LEGIBILITY. AS AN EXAMPLE OF THIS METHODOLOGY, CHECK-READING PERFORMANCE OF 36 SUBJECTS WAS MEASURED FOR A SERIES OF SIX DISPLAYS OF PROGRESSIVELY DEGRADED LEGIBILITY, USING TYPEWRITTEN ERROR PASSAGES RANGING FROM A CLEAR ORIGINAL THROUGH AN OBVIOUSLY ILLEGIBLE FIFTH CARBON COPY. MEAN ERROR DETECTIONS PER MINUTE DECREASED MONOTONICALLY FOR THE SIX CONDITIONS: 12.4, 11.3, 8.4, 4.0, 1.6, 1.2. (A) 4P, 6R.

COMMENTS:

THIS PAPER DESCRIBES A WELL EXECUTED EXPERIMENT ON DISPLAY LEGIBILITY. THE PRIMARY INTENT IS TO DEVELOP A TECHNIQUE FOR ASSESSING DISPLAY LEGIBILITY THAT IS QUICK AND PROVIDES QUANTITATIVE MEASURES. THE SPECIFIC EXPERIMENTAL TASK EMPLOYED WAS NOT SELECTED, THEREFORE, FOR ITS PRACTICAL IMPORTANCE BUT RATHER AS AN APPROPRIATE TEST CASE FOR THE MEASURE PROPOSED. CHECK-READING AND THE ASSOCIATED MEAN ERROR DETECTIONS PER MINUTE MEASURE APPEAR TO BE POTENTIALLY USEFUL IN EVALUATING ALPHABETIC DISPLAYS. IT MIGHT ALSO BE POSSIBLE TO DEVELOP SIMILAR TECHNIQUES FOR NUMERIC AND GRAPHICAL DISPLAYS.

472 COMPARISON OF COLOR AND SHAPE CODING
SMITH, S.L., & THOMAS, D.W. COLOR VERSUS SHAPE CODING IN INFORMATION DISPLAYS.
JOURNAL OF APPLIED PSYCHOLOGY, 1964, 48, 137-146.
DESCRIPTION:

EIGHT SUBJECTS COUNTED OBJECTS IN A SPECIFIED COLOR OF SHAPE ON DISPLAYS OF 20, 60, OR 100 ITEMS. COUNTING TIME INCREASED WITH INCREASING DISPLAY DENSITY. COUNTING BASED ON A 5-VALUED COLOR CODE WAS FASTER AND MORE ACCURATE THAN COUNTING USING ANY OF 3 SHAPE CODES. COLOR COUNTING WAS NOT AFFECTED BY THE PARTICULAR SHAPE CODE ON WHICH THE COLORS WERE SUPERIMPOSED. SHAPE COUNTING WAS SOMEWHAT FASTER AND/OR MORE ACCURATE WHEN COLOR DID NOT VARY ON THE DISPLAY, AND VICE VERSA. DIFFERENCES IN COUNTING PERFORMANCE APPEARED AMONG THE 3 SHAPE CODES AND AMONG CERTAIN OF THE SYMBOLS WITHIN SHAPE CODES, AND SMALL DIFFERENCES WERE CONFIRMED AMONG THE PARTICULAR CODE COLORS USED. (A)

COMMENTS:

THE EXPERIMENT DESCRIBED IN THIS PAPER EXAMINED THE USEFULNESS OF COLOR AS A NONREDUNDANT CODE AND COMPARED COLOR AND SHAPE CODING. ALTHOUGH COLOR CODING WAS FOUND TO BE SUPERIOR IN THIS EXPERIMENT, THE AUTHORS NOTE THAT ITS USEFULNESS MAY DECLINE AS THE NUMBER OF CODE CATEGORIES INCREASES. UNLIKE A PREVIOUS STUDY BY S.L. SMITH (1963), THE PRESENT STUDY INDICATES SIGNIFICANT DIFFERENCES DUE TO PARTICULAR CODE COLORS. THIS PAPER CLEARLY DESCRIBES THE RELATIVE ADVANTAGES OF COLOR AND SHAPE CODING AND WOULD BE OF INTEREST TO ANYONE CONCERNED WITH THESE TOPICS.

473 ERRORS IN DATA ENTRY
SMITH, W.A. ACCURACY OF MANUAL ENTRIES IN DATA-COLLECTION DEVICES. JOURNAL OF
APPLIED PSYCHOLOGY, 1967, 51, 362-368.
DESCRIPTION:

THIS EXPERIMENT EXAMINED THE ACCURACY OF MANUALLY RECORDED MESSAGES SIMILAR TO THOSE ENCOUNTERED IN FIELD STUDIES ON THE ACCURACY OF DATA COLLECTION IN PRODUCTION INFORMATION SYSTEMS. THE HIGH EFFICIENCY IN CORRECTING ERRORS DETECTED AT THE TIME A MESSAGE WAS RECORDED AND THE RELATIVE CONTRIBUTIONS OF FORMAT AND CONTENT MISTAKES TO RESIDUAL ERROR FOUND IN FIELD STUDIES WERE SUFFICIENTLY UNIVERSAL THAT THEY WERE REPRODUCED AND CONFIRMED UNDER LABORATORY CONDITIONS. UNDER CONTROLLED CONDITIONS, MANUAL MESSAGES WHICH WERE 3-, 6-, AND 10-DIGITS LONG COMTRIBUTED SIGNIFICANTLY DIFFERENT QUANTITIES OF BOTH TOTAL AND RESIDUAL ERRORS. IMPOSITION OF A TIME RESTRAINT DID NOT AFFECT THE TOTAL QUANTITY OF MISTAKES, BUT IT DID CONTRIBUTE TO SIGNIFICANT DIFFERENCES IN RESIDUAL ERRORS, AFFECTING BOTH THE ABILITY TO DETECT AND CORRECT MISTAKES AT POINT OF ENTRY. ABOUT ONE-HALF OF ALL THE MISTAKES IN OBSERVED MANUAL MESSAGES UNDER FIELD AND LABORATORY CONDITIONS WERE CAUSED BY SINGLE-DIGIT SUBSTITUTION. OMISSION OF A DIGIT ACCOUNTED FOR ANOTHER 20 PERCENT. TRANSPOSITION MISTAKES WERE MORE FREQUENTLY ENCOUNTERED IN THE LABORATORY EXPERIMENT THAN IN FIELD STUDIES BUT THEY WERE A LESS IMPORTANT CONTRIBUTOR TO INACCURATE DATA RECORDING. (A)

7P, 7R.

THE EXPERIMENT REPORTED IN THIS PAPER WAS, IN GENERAL, CAREFULLY CONDUCTED. THE AUTHOR IS QUITE CORRECT IN NOTING THAT FIELD STUDIES DO NOT ALLOW FOR APPROPRIATE EXPERIMENTAL CONTROL AND THAT THIS LACK OF CONTROL MAY OBSCURE POTENTIALLY RELEVANT EFFECTS. ALTHOUGH THIS EXPERIMENT WAS CAREFULLY CONTROLLED, IT MAY NOT BE AN ADEQUATE EXAMINATION OF DATA ENTRY ERRORS. IN REAL WORLD SETTINGS, THE MAJORITY OF UNDETECTED ERRORS INVOLVE INACCURATE DESCRIPTIONS OF EVENTS. THE PARADIGN USED IN THIS EXPERIMENT, HOWEVER, DID NOT PERMIT THIS TYPE OF ERROR TO BE MADE. THIS PAPER DOES, HOWEVER, INDICATE THE FEASIBILITY OF CONTROLLED STUDIES AND WOULD BE RELEVANT TO THOSE INTERESTED IN THE TYPES OF ERRORS ASSOCIATED WITH DATA ENTRY.

474 DATA ENTRY ERRORS

SMITH, W.A., JR. DATA COLLECTION SYSTEMS: PART I: CHARACTERISTICS OF ERRORS. JOURNAL OF INDUSTRIAL ENGINEERING, 1967, 18, 703-707. DESCRIPTION:

THIS ARTICLE INVESTIGATES AND ANALYZES THE ACCURACY OF PRODUCTION DATA RECORDED IN MACHINE READABLE FORM FOR THE PURPOSE OF ENHANCING THE DESIGN AND IMPLEMENTATION PHASES OF INFORMATION SYSTEMS DEVELOPMENT. THE DATA COLLECTED IN THREE DIFFERENT PRODUCTION SITUATIONS, ONE ASSEMBLY AND TWO JOB SHOPS, ARE ANALYZED AND THE CHARACTERISTICS AND QUANTITY OF ERRORS ARE DETERMINED. (A)

5P, 3R.

INCIDENCE AND TYPES OF DATA ENTRY ERRORS ARE REPORTED FOR THREE DIFFERENT PRODUCTION-LINE SETTINGS. INSUFFICIENT INFORMATION ABOUT DATA ENTRY TASKS PRECLUDES GENERALIZATION FROM THESE DATA OR DETAILED ANALYSIS. HOWEVER, THE AUTHOR'S DISCUSSION PROVIDES INSIGHT INTO SOME CAUSES OF ERRORS AND SHOULD ASSIST THOSE CONCERNED WITH PRODUCTION DATA ENTRY DEVICES, FORMAIS, AND PROCEDURES.

475 ENVIRONMENTAL CAUSES OF DATA ENTRY ERRORS
SMITH, W.A., JR. DATA COLLECTION SYSTEMS: PART II: ENVIRONMENTAL EFFECTS ON ACCURACY. JOURNAL OF INDUSTRIAL ENGINEERING, JANUARY 1968, 19(1), 24-31.
DESCRIPTION:

A PREVIOUS ARTICLE (W.A. SMITH, JR., 1967) INVESTIGATED AND ANALYZED THE ACCURACY OF PRODUCTION DATA RECORDED IN MACHINE READABLE FORM FOR THE PURPOSE OF ENHANCING THE DESIGN AND IMPLEMENTATION PHASES OF INFORMATION SYSTEMS DEVELOPMENT. THE PURPOSE OF THE PRESENT STUDY IS TO FURTHER INVESTIGATE AND CHARACTERIZE THE ACCURACY OF SUCH DATA. DATA WERE ANALYZED WITH RESPECT TO INDIVIDUAL DIFFERENCES, SHIFT DIFFERENCES, AND SITE DIFFERENCES. A LABORATORY STUDY WAS CONDUCTED TO DETERMINE THE EFFECTS OF MESSAGE SIZE AND TIME PRESSURE ON ACCURACY.

BP, SR.

COMMENTS:

THE VARIABLES INCLUDED IN THIS STUDY INCLUDED TYPE OF DATA ENTRY DEVICE, WORK SHIFT, AND PRODUCTION LINE SETTING. THE DESCRIPTION OF THE EXPERIMENTAL PROCEDURE IS NOT ADEQUATE TO ALLOW A GENERALIZATION OF THESE RESULTS. AN INTERESTING RESULT WAS THAT ALTHOUGH INDIVIDUAL DIFFERENCES AND ENVIRONMENTAL EFFECTS STRONGLY INFLUENCE DATA ENTRY ERRORS, THE PROPORTION OF UNDETECTED ERRORS IS FAIRLY CONSTANT ACROSS A VARIETY OF CONDITIONS. ALTHOUGH THIS RESULT IS POTENTIALLY VERY IMPORTANT, A FORMAL ANALYSIS OF DATA TO CONFIRM THIS RESULT IS NOT PRESENTED.

476 CHILD'S USE OF INTERACTIVE GRAPHICS
SOLOMON, C.J., & PAPERT, S. A CASE STUDY OF A YOUNG CHILD DOING TURTLE
GRAPHICS IN LOGO. AFIPS CONFERENCE PROCEEDINGS, 1976, 45, 1049-1056.
DESCRIPTION:

THIS PAPER EXPLORES SOME IMPORTANT ISSUES WITH REGARD TO USING COMPUTERS IN EDUCATION. IT PROBES INTO THE QUESTION OF WHAT PROGRAMMING IDEAS AND PROJECTS WILL ENGAGE YOUNG CHILDREN. IN PARTICULAR, A SEVEN YEAR-OLD CHILD'S INVOLVEMENT IN TURTLE GRAPHICS IS PRESENTED AS A CASE STUDY. 8P, 9R.

COMMENTS:

THIS IS AN INFORMALLY WRITTEN AND EASILY READ PAPER. USING A CASE STUDY AS AN EXAMPLE, THE AUTHORS DESCRIBE AN ARTIFICIAL INTELLIGENCE PROJECT DIRECTED AT TEACHING YOUNG CHILDREN TO WRITE AND DEBUG PROGRAMS USING COMPUTER GRAPHICS. ALTHOUGH DIRECTED TOWARD CHILDREN AND ARTIFICIAL INTELLIGENCE, THIS, AND RELATED, PAPERS PROVIDE INTERESTING INSIGHTS INTO THE PROCESSES OF PROGRAMMING AND DEBUGGING, AND THE MOTIVATING EFFECT OF INTERACTIVE GRAPHICS.

477 LANGUAGE FOR CONTROL OF INTERACTIVE SYSTEM SIMULATION SPESOCK, G.J., & LINCOLN, R.S. HUMAN FACTORS ASPECTS OF DIGITAL COMPUTER PROGRAMMING FOR SIMULATOR CONTROL. HUMAN FACTORS, 1965, 7, 473-482. (NTIS NO. AD 637894) DESCRIPTION:

EXISTING PROGRAM COMPILERS ARE NOT APPLICABLE TO SUCH "REAL-TIME" PROGRAMMING TASKS AS DISPLAY/CONTROL SIMULATION ON A SMALL COMPUTER IN A HUMAN FACTORS LABORATORY. THIS PAPER DESCRIBES A COMPILER DEVELOPED FOR THIS APPLICATION. A DISCUSSION OF HUMAN FACTORS CONSIDERATIONS IN COMPILER DEVELOPMENT AND OF THE FUNCTIONAL REQUIREMENTS FOR A REAL-TIME SIMULATION COMPILER IS PRESENTED. THE PEPSS (PROGRAMMABLE EQUIPMENT FOR PERSONNEL SUBSYSTEM SIMULATION) COMPILER IS DESCRIBED. THIS COMPILER USES AN ABBREVIATED VOCABULARY WITH NATURAL-LANGUAGE SYNTAX TO DESCRIBE SETS OF EVENTS, ACTIONS, AND EVENT-ACTION RELATIONSHIPS RELEVANT TO THE DISPLAYS AND CONTROLS ON A DISPLAY PANEL. THE RESULTING PROGRAM SPECIFIES A SET OF DISPLAY AND CONDITION CHANGES WHICH MAY OCCUR AS A RESULT OF SUBJECT ACTIONS AND TIME DELAYS.

COMMENTS:

ALTHOUGH THIS PAPER IS PRIMARILY CONCERNED WITH A PARTICULAR COMPILER USED TO DRIVE DISPLAY AND CONTROL SIMULATIONS IN A HUMAN FACTORS LABORATORY, IT DOES BRIEFLY ADDRESS SOME OF THE HUMAN FACTORS ASPECTS OF COMPILER LANGUAGES IN GENERAL, AND REAL-TIME SIMULATOR CONTROL LANGUAGES IN PARTICULAR. THE DISCUSSION IS RATHER PRIMITIVE BY MODERN STANDARDS, BUT MAY INTEREST THOSE WITH A HISTORICAL BENT. THE COMPILER ITSELF IS A SIMPLE ONE, APPROPRIATE ONLY FOR RELATIVELY SIMPLE SIMULATIONS OR EXPERIMENTS WHICH DO NOT INVOLVE COMPLEX TEMPORAL PROPERTIES AND CONTINGENT EVENTS.

478 MAN-COMPUTER INTERACTION IN DECISION AIDING SYSTEMS
STEEB, R., & FREEDY, A. MAN-MACHINE INTERACTION IN ADAPTIVE REMOTE SYSTEMS.
IN PROCEEDINGS, IEEE INTERNATIONAL CONFERENCE ON CYBERNETICS AND SOCIETY,
NOVEMBER 1976. NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS,
INC., 1976, 727-731.

DESCRIPTION:

SHARED DECISION MAKING BETWEEN MAN AND INTELLIGENT MACHINE IS BECOMING AN IMPORTANT PART OF ADVANCED SYSTEMS. THE RESEARCH DESCRIBED IN THIS PAPER IS DIRECTED TOWARD DEVELOPING HUMAN FACTORS CRITERIA FOR THE MAN-MACHINE INTERACTION. THE RESEARCH EFFORT INCLUDES EVALUATIONS OF TASK ALLOCATION TECHNIQUES, INFORMATION FEEDBACK, OPERATOR TRAINING, AND DECISION ANALYSIS METHODS.

THE PAPER PRESENTS THE RESULTS OF SEVERAL EXPERIMENTAL INVESTIGATIONS OF ADAPTIVE COMPUTER-AIDED CONTROL. THE FINDINGS SUGGEST THAT CONTROL ALLOCATION AND MACHINE STATE FEEDBACK ARE PERHAPS THE MAJOR FACTORS IN THESE INTERACTIONS, AND THAT AUTOMATIC ALLOCATION SHOULD BE A PRIMARY FUNCTION OF THE MACHINE COMPONENT. THE PAPER CONCLUDES WITH A DISCUSSION OF THE DUAL FUNCTIONS OF INFORMATION MANAGEMENT AND ALLOCATION OF CONTROL.

COMMENTS:

SEVERAL STUDIES HAVE BEEN PERFORMED BY THESE AUTHORS AND THEIR ASSOCIATES ON THE USE OF ADAPTIVE AIDING IN CONTROL TASKS WITH PRIMARY EMPHASIS ON AUTOMATIC TAKEOVER OF THE DECISION TASK BY THE COMPUTER. ALL OF THESE PAPERS REPORT IMPROVED PERFORMANCE WITH AUTOMATIC TAKEOVER. NONE, HOWEVER, ADEQUATELY ADDRESS THE 'ESSENTIAL QUESTION OF USER ACCEPTANCE OF SUCH AN AID. THE PRESENT STUDY IS DESCRIBED ONLY BRIEFLY AND THE REPORTED CONCLUSIONS ARE NOT SUPPORTED HERE BY EMPIRICAL DATA. AN EVALUATION OF USER ACCEPTANCE AND CONSIDERATION OF OTHER TASK DOMAINS WOULD BE VERY USEFUL.

479 INTERACTIVE GRAPHICS FOR PLANNING WITH CRITICAL PATH METHODS
STEELE, K.A. CPM/PERT. IN PROCEEDINGS, 2ND MAN-COMPUTER COMMUNICATIONS SEMINAR. OTTAWA, CANADA: NATIONAL RESEARCH COUNCIL OF CANADA, 1971, 81-84.
DESCRIPTION:

THIS PAPER DESCRIBES THE DEVELOPMENT OF INTERACTIVE COMPUTER GRAPHICS TECHNIQUES TO AID IN NETWORK PLANNING. THE SYSTEM DISCUSSED USES A DIRECT-VIEW STORAGE TUBE INTERFACED TO A COMPUTER IN A TIME-SHARING MODE. THE ADVANTAGES AND DISADVANTAGES OF THIS CONFIGURATION FOR NETWORK PLANNING ARE CONSIDERED.

4P, OR.

COMMENTS:

THIS IS A BRIEF, NON-TECHNICAL PAPER THAT CONSIDERS THE ADVANTAGES OF INTERACTIVE GRAPHICS FOR NETWORK PLANNING AND ALSO CONSIDERS THE RELATIVE ADVANTAGES OF A DIRECT-VIEW STORAGE TUBE AS COMPARED TO A CONVENTIONAL REFRESHED DISPLAY.

480 SOCIAL IMPLICATIONS OF COMPUTERS
STERLING, T.D. GUIDELINES FOR HUMANIZING COMPUTERIZED INFORMATION SYSTEMS: A
REPORT FROM STANLEY HOUSE. COMMUNICATIONS OF THE ACM, 1974, 17, 609-613.
DESCRIPTION:

THIS REPORT IS THE RESULT OF AN INTENSIVE ANALYSIS OF THE CONDITIONS THAT MAY HUMANIZE OR DEHUMANIZE PARTICIPANTS IN VARIOUS COMPUTERIZED SYSTEMS. THE GUIDELINES PRESENTED HERE WERE GENERATED DURING A WEEK-LONG WORKSHOP SPONSORED BY CANADA COUNCIL AT CAMADA COUNCIL'S STANLEY HOUSE. (A, ABBR.) THE PRESENTED GUIDELINES ARE GROUPED INTO FIVE BROAD CATEGORIES: (1) PROCEDURES FOR DEALING WITH USERS, (2) PROCEDURES FOR DEALING WITH "EXCEPTIONS," (3) PROCEDURES FOR DEALING WITH INFORMATION, (4) THE PROBLEM OF PRIVACY, AND (5) GUIDELINES FOR SYSTEM DESIGN HAVING A BEARING ON ETHICS. SP, 17R.

COMMENTS:

THE PRESENTED GUIDELINES ARE VERY BROAD (E.G., THE LANGUAGE OF THE SYSTEM SHOULD BE EASY TO UNDERSTAND) ARE NOT INTENDED TO APPLY TO BOTH MANUAL AND COMPUTERIZED SYSTEMS. IT WOULD BE VERY DIFFICULT TO ARGUE THAT ANY OF THESE GUIDELINES ARE INAPPROPRIATE. IT IS NOT CLEAR, HOWEVER, HOW SOME OF THESE GUIDELINES SHOULD BE IMPLEMENTED IN A COMPUTERIZED SYSTEM, OR THE COSTS INVOLVED, AND THIS ISSUE IS NOT ADDRESSED.

481 AVOIDANCE OF "DEHUMANIZING" EFFECT OF COMPUTER SYSTEMS
STERLING, T.D. HUMANIZING COMPUTERIZED INFORMATION SYSTEMS. SCIENCE, 1975,
190, 1168-1172.
DESCRIPTION:

COMPUTERIZED MANAGEMENT INFORMATION SYSTEMS ARE BEGINNING TO DOMINATE THE ECONOMIC, SOCIAL, AND POLITICAL MANAGEMENT OF SOCIETY. THE WIDESPREAD USE AND INCREASING POWER OF SUCH SYSTEMS LEADS TO PROCEDURAL FEATURES THAT MAY DEHUMANIZE BOTH INDIVIDUAL USERS AND SOCIETY IN GENERAL. IN AN EFFORT TO IDENTIFY CRUCIAL DESIGN FEATURES THAT INFLUENCE THE HUMANIZING OR DEHUMANIZING QUALITIES OF INFORMATION SYSTEMS, THIS PAPER REVIEWS PROPOSED CRITERIA FOR HUMANIZING INFORMATION SYSTEMS AND THE IMPLICATIONS OF THESE CRITERIA. THESE CRITERIA INCLUDE PROCEDURES FOR DEALING WITH USERS, PROCEDURES FOR DEALING WITH EXCEPTIONS, ACTION OF THE SYSTEM WITH RESPECT TO INFORMATION, THE PROBLEM OF PRIVACY, AND ETHICAL CONSIDERATIONS.

COMMENTS:

WITHIN THIS PAPER, "HUMANIZING" INCLUDES SUCH ASPECTS AS EASE OF USE, PRIVACY, FLEXIBILITY, AND THE IMPACT OF COMPUTERS ON SOCIETY. SOME OF THE CRITERIA DISCUSSED IN THIS PAPER ARE WELL WITHIN THE BOUNDS OF WHAT ARE GENERALLY PROPOSED AS DESIGN GUIDELINES, BUT OTHERS ARE INTENDED TO EXTEND THIS BOUNDARY. EXAMPLES OF THE FORMER TYPE INCLUDE FAST SYSTEM RESPONSE TIME AND EASILY UNDERSTOOD DIALOGUES. EXAMPLES OF THE SECOND TYPE INCLUDE RESPONSIBILITIES TO PERSONNEL WHO ARE REPLACED BY AUTOMATED SYSTEMS AND "COURTEOUS" AND "CONSIDERATE" INTERACTION. WHILE ALL OF THESE CRITERIA COULD BE CONSIDERD UNDER THE GENERAL TOPIC OF USER ACCEPTANCE, THE AUTHOR'S EXPRESSED CONCERN IS WITH THE USER'S "DIGNITY AND HUMANITY." ALTHOUGH LAWS AND RULES HAVE BEEN FORMULATED FOR INTERPERSONAL INTERACTIONS, FEW LEGAL GUIDELINES APPLY TO MAN-COMPUTER INTERACTIONS. THIS PAPER PRESENTS SOME INTERESTING ARGUMENTS IN FAVOR OF THE DEVELOPMENT OF SUCH GUIDELINES.

482 SURVEY OF USERS OF PROBLEM-SOLVING AIDS
STEWART, T.F.M. ERGONOMIC ASPECTS OF MAN-COMPUTER PROBLEM SOLVING. APPLIED
ERGONOMICS, 1974, 5, 209-212.
DESCRIPTION:

THE PAPER REPORTS A SURVEY OF INTERACTIVE COMPUTER USAGE BY DESIGNERS, ENGINEERS, ECONOMISTS AND OTHER SPECIALISTS IN SEVERAL INDUSTRIAL TORGANIZATIONS. SIXTY-NINE OF THESE SPECIALISTS WERE INTERVIEWED ABOUT BOTH HARDWARE INTERFACE PROBLEMS, E.G., KEYBOARD LAYOUT, AND SOFTWARE INTERFACE PROBLEMS, E.G. HOW SYSTEM ORGANIZATION AFFECTS THE WAY THE SPECIALIST TACKLES HIS WORK. THE RESULTS OF THE SURVEY SHOW THAT INTERACTIVE COMPUTING CAN BE OF CONSIDERABLE ASSISTANCE TO SPECIALISTS, ALTHOUGH THERE ARE OFTEN MANY DIFFICULTIES IN USING THE COMPUTER SYSTEM TO FULL ADVANTAGE. (A)

COMMENTS:

THIS IS A BRIEF DISCUSSION OF COMPUTER-AIDED PROBLEM SOLVING IN FINANCIAL MODELING AND STRUCTURAL ANALYSIS TASKS. OF GENERAL INTEREST IS THE FACT THAT A LARGE NUMBER OF USERS FOUND THE MAN-COMPUTER INTERFACE TO BE UNSATISFACTORY; HALF OF THOSE USING ON-LINE TERMINALS COMPLAINED OF INADEQUATE WORKPLACE DESIGN, ONE QUARTER HAD DIFFICULTIES IN OPERATING THE TERMINAL ITSELF, AND ONE QUARTER HAD DIFFICULTIES WITH THE SOFTWARE AND OPERATING PROCEDURES. IN THE FINANCIAL MODELING TASK, THE PROBLEM SOLVER WAS PROVIDED WITH THE MEANS TO CONSIDER MORE EQUATIONS THAN COULD BE CONSIDERED WITHOUT A COMPUTER AID AND IN THE STRUCTURAL ANALYSIS TASK, THE METHODS THAT AN ENGINEER COULD APPLY WERE RESTRICTED TO THOSE THAT COULD BE STORED, EXECUTED, AND ANALYZED BY A COMPUTER AID. ALTHOUGH THE AUTHOR REFERS TO THESE AIDS, RESPECTIVELY, AS "EXPANDING THE PROBLEM SPACE" AND "REDUCING THE PROBLEM SPACE," THEY CAN ALSO BE VIEWED AS PROVIDING AN EXTERNAL MEMORY AND PROVIDING A CHANGE OF PROBLEM REPRESENTATION. REGARDLESS OF INTERPRETATION, HOWEVER, THIS DOES INDICATE THAT DIFFERENT TYPES OF COMPUTER AIDS ARE REQUIRED FOR DIFFERENT TYPES OF TASKS.

483 GUIDELINES FOR INTERFACE DESIGN
STEWART, T.F.M. DISPLAYS AND THE SOFTWARE INTERFACE. APPLIED ERGONOMICS,
1976, 7, 1.7-146.

DESCRIPTION:

EFFECTIVE AND SUCCESSFUL MAN-COMPUTER SYSTEMS REQUIRE MORE THAN ELEGANT COMPUTERS AND TRAINED OPERATORS AND USERS -- THEY REQUIRE WELL DESIGNED INTERFACES BETWEEN MAN AND COMPUTER. COMPUTER SYSTEMS COMPRISE HARDWARE AND SOFTWARE, AND IT IS ESSENTIAL THAT BOTH PARTS OF THE SYSTEM PRESENT SUITABLE INTERFACES TO THEIR USERS. THERE IS A SUBSTANTIAL BODY OF ERGONOMIC AND HUMAN FACTORS KNOWLEDGE WHICH CAN HELP IN THE DESIGN OF SUCH INTERFACES, BUT IT IS OFTEN DIFFICULT FOR THE DESIGNER TO SEE HOW SOME OF THE INFORMATION CAN BE APPLIED TO HIS OWN SPECIFIC SITUATIONS. THE AIM OF THIS PAPER, THEREFORE, IS TO PRESENT A PRELIMINARY CLASSIFICATION OF THE SOFTWARE INTERFACE WHICH IT IS HOPED WILL HELP DESIGNERS TO ORGANIZE AND MAKE SENSE OF SOME OF THE EXISTING LITERATURE. BEFORE THE CLASSIFICATION IS DESCRIBED, A NUMBER OF GENERAL INTERFACE ISSUES ARE DISCUSSED. THE FINAL PART OF THE PAPER ILLUSTRATES THE USE OF THE CLASSIFICATION AND CONTAINS A NUMBER OF HUMAN FACTORS RECOMMENDATIONS FOR THE DESIGN OF COMPUTER DISPLAYS. (A)

COMMENTS:

THIS PAPER DESCRIBES THE SOFTWARE INTERFACE IN TERMS OF FUNCTION ASPECTS AND DIALOGUE STRUCTURE ASPECTS. NUMEROUS EVIDELINES ARE THEN SUGGESTED FOR THE DESIGN OF CRT DISPLAYS. ALTHOUGH THESE GUIDELINES ARE, IN GENERAL, SUPPORTED BY RESEARCH PRESENTED ELSEWHERE, NO REFERENCE IS MADE TO THIS LITERATURE. AS A CONVENIENT SOURCE OF INFORMATION ON DISPLAY FORMATS, CODING, SIZE, AND TYPOGRAPHY, THIS PAPER IS VERY GOOD.

SCIENTIFIC AND TECHNICAL USERS
STEWART, T.F.M. THE SPECIALIST USER. PAPER PRESENTED AT NATO ADVANCED
STUDY INSTITUTE ON MAN-COMPUTER INTERACTION, MATI, GREECE, SEPTEMBER 1976
(REPRINTED BY DEPARTMENT OF HUMAN SCIENCES, UNIVERSITY OF TECHNOLOGY,
LOUGHBOROUGH, LEICESTERSHIRE, ENGLAND).
DESCRIPTION:

THIS PAPER DISCUSSES THE SPECIALIZED NEEDS AND PROBLEMS OF SCIENTIFIC AND TECHNICAL USERS OF COMPUTER AIDS. REQUIREMENTS OF THIS GENERAL CLASS OF USER ARE DISCUSSED IN THE AREAS OF DATA ENTRY, OUTPUT, AND PROCESSING CONTROL. THREE BASIC APPROACHES TO COMPUTERIZED PROBLEM-SOLVING AIDS ARE DISCUSSED: DATA INPUT FOR PREDEFINED OUTPUT, INSTRUCTIONS FOR DATA PROCESSING, AND HIGH-LEVEL LANGUAGE PROCESSING. USERS OF THE LATTER CATEGORIES HAVE PROGRESSIVELY MORE DIRECT INVOLVEMENT IN TOOL DEVELOPMENT AND MODIFICATION. THEY MAY THEREFORE INCUR GREATER OVERHEAD BURDENS, AND MAY TEND TO SELECT OR MODIFY TASKS TO FIT THEIR AVAILABLE TOOLS. IN VARIOUS WAYS, THESE APPROACHES MAY ALL LEAD TO THE DEVELOPMENT OF PSYCHOLOGICAL SETS WHICH INTERFERE WITH CREATIVE PROBLEM SOLVING. SEVERAL SUGGESTIONS ARE MADE: REDUCE FRAGMENTATION OF THE PROBLEM-SOLVING PROCESS, REDUCE SEPARATION BETWEEN TASKS OF TOOL DEVELOPMENT AND TOOL USE, AND USE PROFESSIONAL PROGRAMMERS IN PREFERENCE TO EXTENSIVE PROGRAMMING BY SCIENTIFIC AND TECHNICAL USERS.

COMMENTS:

THE PRIMARY CONCERN OF THIS PAPER IS THE IMPACT OF COMPUTER AIDS AND RELATED PROCEDURES ON THE PROBLEM-SOLVING PROCESS OF SCIENTIFIC AND TECHNICAL ("SPECIALIST") USERS. IT IS AN OPINION PAPER, RATHER THAN A PRESENTATION OF EMPIRICAL RESULTS. ALTHOUGH THE AUTHOR HAS SOME USEFUL IDEAS FOR IMPROVING THE PROBLEM-SOLVING PERFORMANCE OF TECHNICAL PERSONNEL AND GROUPS, IT SHOULD BE NOTED THAT THEY ARE MOSTLY PROCEDURAL, AND CONCERN HOW COMPUTER AIDS SHOULD BE BUILT AND USED RATHER THAN THE PROPERTIES THEY SHOULD HAVE. THE PAPER CONTAINS A PARTICULARLY INTERESTING DISCUSSION OF THE EFFECT OF PSYCHOLOGICAL SET ON PROBLEM SOLVING, AND THE USE OF INTENTIONAL MECHANISMS TO DISRUPT SUCH SETS IN ORDER TO STIMULATE CREATIVE PROBLEM SOLVING. THE PAPER SHOULD BE OF INTEREST TO THOSE CONCERNED WITH SCIENTIFIC AND TECHNICAL APPLICATIONS AND TO THOSE CONCERNED WITH THE MANAGEMENT OF TECHNICAL PROBLEM-SOLVING ACTIVITIES.

485 DISPLAY DESIGN FOR COMPUTER OPERATORS

STEWART, T.F.M. DISPLAY SYSTEM DESIGN FOR IMPROVED OPERATOR ORGANISATION. IN PROCEEDINGS, IEE DISPLAYS CONFERENCE, APRIL 1977, LANCASTER, ENGLAND. LONDON, ENGLAND: INSTITUTION OF ELECTRICAL ENGINEERS, 1977, 82-85. DESCRIPTION:

MANY PAPERS AND TEXTBOOKS ON THE DESIGN OF DISPLAYS AND DISPLAY SYSTEMS RECOMMEND THAT INFORMATION SHOULD BE PRESENTED IN A FORM WHICH CORRESPONDS TO THE OPERATOR'S MENTAL MODEL OF THE PROCESS BEING MONITORED. IN APPLYING THIS PRINCIPLE TO THE DESIGN OF OPERATOR'S CONSOLE DISPLAYS FOR A NEW SERIES OF COMPUTER, IT WAS FOUND THAT RELATIVELY LITTLE WAS KNOWN ABOUT THE CHARACTERISTICS OF COMPUTER OPERATORS GENERALLY AND EVEN LESS WAS KNOWN ABOUT THEIR MENTAL MODEL OF THEIR COMPUTER SYSTEMS. AS A RESULT, A SMALL SURVEY WAS CONDUCTED OF 34 OPERATORS FROM FIVE LARGE COMPUTER INSTALLATIONS. ALTHOUGH THE SURVEY WAS PRIMARILY A PILOT STUDY, SOME USEFUL AND SURPRISING DATA WAS OBTAINED ABOUT OPERATORS, THEIR JOB AND THEIR VIEW OF THE COMPUTERS THEY OPERATED. THIS PAPER BRIEFLY REPORTS THE DATA AND DISCUSSES SOME OF THE CONSEQUENCES OF THE RESULTS FOR DESIGNING DISPLAYS TO BE USED BY COMPUTER OPERATORS. (A, ABBR.)

COMMENTS:

UNDERSTANDING HOW A USER VIEWS HIS TASK IS A USEFUL, PERHAPS NECESSARY, PREREQUISITE TO DESIGNING EFFECTIVE DISPLAYS. THIS PAPER IS PRIMARILY CONCERNED WITH HOW COMPUTER OPERATORS VIEW THEIR JOB AND DOES NOT, EXCEPT AT A VERY GENERAL LEVEL, RELATE THIS TO DISPLAY DESIGN. THE AUTHOR DESCRIBES THE TYPES OF TASKS THAT A COMPUTER OPERATOR PERFORMS, HOW THEY RELATE TO COMPUTER ACTIVITIES OR FUNCTIONS (INPUT, OUTPUT, ETC.) AND THE PROPORTION OF TIME SPENT ON EACH TASK. THE TWO PRINCIPAL CONCEPTS APPEAR TO BE THAT DISPLAYS SHOULD BE ORGANIZED ACCORDING TO COMPUTER FUNCTIONS SO THAT EACH OPERATOR CAN FOLLOW THROUGH COMPLETE OPERATIONS RATHER THAN HAVING EACH CPERATOR PERFORM A SINGLE TASK ON SEVERAL, OR ALL, FUNCTIONS AND THAT DISPLAYS SHOULD BE AVAILABLE TO ALL OPERATORS. THESE CONCEPTS, AND ESPECIALLY THE FIRST, MAY BE STRONGLY RELATED TO USER ACCEPTANCE AND JOB SATISFACTION.

486 TERMINAL DESIGN

STEWART, T.F.M., OESTBERG, O., & MACKAY, C.J. COMPUTER TERMINAL ERGONOMICS; A REVIEW OF RECENT HUMAN FACTORS LITERATURE. STOCKHOLM, SWEDEN: STATSKONTORET, 1974. (AVAILABLE FROM STATSKONTORET, FACK, S-10026, STOCKHOLM, SWEDEN) DESCRIPTION:

THIS PAPER PROVIDES A REVIEW OF THE LITERATURE ON HUMAN FACTORS ASPECTS OF DATA ENTRY, KEYBOARDS, VISUAL DISPLAYS, CRT DISPLAYS, WORKPLACE DESIGN, AND SUCH SYSTEM FACTORS AS BATCH PROCESSING VERSUS TIME-SHARING AND SYSTEM RESPONSE TIME. BASED ON THIS REVIEW, RECOMMENDATIONS ARE MADE FOR THE DESIGN AND IMPLEMENTATION OF COMPUTER TERMINALS.

114P, 176R.

COMMENTS:

THE AUTHORS HAVE ATTEMPTED TO COVER SEVERAL VERY BROAD SUBJECT AREAS IN A RELATIVELY SMALL NUMBER OF PAGES. IN GENERAL, THEY HAVE CITED THE MOST IMPORTANT REFERENCES IN EACH AREA AND HAVE PRESENTED A COMPREHENSIBLE AND INTEGRATED REVIEW. NO ATTEMPT IS MADE TO COMMENT ON THE VALIDITY OR RELIABILITY OF THE REVIEWED EMPIRICAL STUDIES. THE RECOMMENDATIONS MADE ARE MORE IN THE FORM OF GUALITATIVE RECOMMENDATIONS THAN OF QUANTITATIVE GUIDELINES FOR MOST OF THE TOPICS INCLUDED IN THIS PAPER CAN BE FOUND IN VARIOUS CHAPTERS OF H.P. VAN COTT AND R.G. KINKADE (1972). ALTHOUGH QUALITATIVE RECOMMENDATIONS MAY APPEAR TO BE OF LESS USE THAN QUANTITATIVE GUIDELINES, THEY MAY, IN FACY, BE MORE GENERAL. WHILE QUANTITATIVE GUIDELINES, THEY MAY, IN FACY, BE MORE GENERAL. WHILE QUANTITATIVE GUIDELINES ARE DEFINITELY SUPERIOR FOR SITUATIONS INVOLVING A WELL-DEFINED CLASS OF OPERATORS WORKING WITH A WELL-DEFINED SYSTEM IN A LIMITED TASK DOMAIN, QUALITATIVE RECOMMENDATIONS MAY BE USEFUL IN A BROADER RANGE OF APPLICATIONS SINCE THEY TEND TO POINT DESIGNERS IN THE RIGHT DIRECTION AND LET THEM FILL IN THE DETAILS AS ARE APPROPRIATE FOR THE GIVEN SITUATION.

487 ILLUMINATION LEVELS FOR BOTH ILLUMINATED DISPLAYS AND HARDCOPY STOCKER, A.C. DISPLAYS, PAPERS, AND LIGHTING: THE VISUAL SYSTEM IN COMMAND CENTERS. INFORMATION DISPLAY, SEPTEMBER/OCTOBER 1964, 1(1), 16-26. DESCRIPTION:

IN MANY APPLICATIONS, PERSONNEL MUST READ CRT DISPLAYS, PROJECTION DISPLAYS, AND HARD COPY UNDER THE SAME LEVEL OF ILLUMINATION. OPTIMAL ILLUMINATION LEVEL, HOWEVER, VARIES CONSIDERABLY FROM DISPLAY TO DISPLAY. THIS PAPER DESCRIBES A METHOD FOR COMPUTING THE ILLUMINATION AT WHICH BOTH DISPLAYS AND HARD COPY CAN BE READ WITH EQUAL EASE.

COMMENTS:

THIS PAPER DESCRIBES A RELATIVELY STRAIGHTFORWARD TECHNIQUE FOR DETERMINING THE OPTIMAL COMMON ILLUMINATION LEVEL FOR A VARIETY OF TYPES OF DISPLAYS. THIS TECHNIQUE INVOLVES DISPLAY PARAMETERS SUCH AS CHARACTER SIZE, CONTRAST, ETC., WHICH IS READILY AVAILABLE FOR MOST DISPLAY DEVICES. ENVIRONMENTAL FACTORS THAT EFFECT ILLUMINATION LEVELS ARE BRIEFLY CONSIDERED.

488 INTERACTIVE GRAPHICS

STOCKHAM, T., JR., & KESSELMAN, M. MAN-MACHINE COMMUNICATIONS (TECHNICAL REPORT RADC-TR-74-97). GRIFFISS AIR FORCE BASE, NEW YORK: RCME AIR DEVELOPMENT CENTER, OCTOBER 1973. (NTIS NO. AD 782444) DESCRIPTION:

THE OBJECTIVE OF THE RESEARCH EFFORT REPORTED HEREIN WAS THE DEVELOPMENT OF COMPUTERS AND COMPUTING TECHNIQUES THAT AID PEOPLE IN SOME AREAS NOT TRADITIONALLY SUBJECT TO THE APPLICATION OF COMPUTERS.

THE COMPUTER GRAPHICS EFFORT HAS DEVELOPED COMPUTING TECHNIQUES AND ORIGINAL COMPUTER COMPONENTS TO ACCOMPLISH THE REALISTIC DISPLAY OF MATHEMATICALLY DESCRIBED, THREE-DIMENSIONAL OBJECTS. ALTHOUGH THE PRIMARY EMPHASIS WAS IN THE DISPLAY OF SOLID OBJECTS (E.G., COMPUTER GENERATED TELEVISION IMAGES), SOME EFFORT WAS DEVOTED TO THE MORE TRADITIONAL, LINEDRAWING GRAPHICS AS AN INTERACTIVE AID TO THE PROGRAMMING AND OPERATION OF LARGE COMPUTER PROCESSES -- RANGING FROM 3-D DISPLAY PROBLEMS TO A STUDY IN THE FLUID DYNAMICS OF BLOOD.

THE WAVEFORM PROCESSING EFFORT, WHICH HAS GROWN AND CONTINUES UNDER A SUBSEQUENT CONTRACT, HAS USED A DIGITAL COMPUTER NOT ONLY FOR DIRECT RESULTS, IN THE FORM OF PROCESSED IMAGE AND AUDIO WAVEFORMS, BUT ALSO FOR THE SIMULATION OF NEW TECHNIQUES (E.G., VOCODING) WHICH SHOW PROMISE OF RELATIVELY INEXPENSIVE IMPLEMENTATION IN SPECIAL PURPOSE HARDWARE.

THE SYMBOLIC COMPUTATION EFFORT HAS PRODUCED AND IS CONTINUING TO IMPROVE, MAINTAIN AND DISTRIBUTE A PROGRAMMING LANGUAGE AND SUBSYSTEM, REDUCE, WHICH IS OF AID IN THE EXTREMELY COMPLICATED ALGEBRAIC MANIPULATION ENCOUNTERED, AMONG OTHER PLACES, IN THEORETICAL PHYSICS. THIS SUBSYSTEM WAS DESIGNED TO BE MINIMALLY MACHINE DEPENDENT AND HAS BEEN TRANSFERRED TO A NUMBER OF DIFFERENT MACHINES, PRIMARILY VIA THE ARPA NETWORK. (A) 115P, 73R.

COMMENTS:

THIS PAPER IS A DETAILED DISCUSSION OF A FAIRLY SOPHISTICATED COMPUTER GRAPHICS SYSTEM. THIS DISCUSSION FOCUSES ON TECHNICAL ASPECTS OF THE IMPLEMENTATION AND IGNORES SERIOUS CONSIDERATION OF THE MAN-COMPUTER INTERFACE.

### 489 DATA ENTRY

STRUB, M.H. EVALUATION OF MAN-COMPUTER INPUT TECHNIQUES FOR MILITARY INFORMATION SYSTEMS (TECHNICAL RESEARCH NOTE 226). ARLINGTON, VIRGINIA: U.S. ARMY BEHAVIOR AND SYSTEMS RESEARCH LABORATORY, MAY 1971. (NTIS NO. AD 730315) DESCRIPTION:

THIS PAPER DESCRIBES THE EVALUATION, IN TERMS OF SPEED AND ACCURACY, OF FOUR CONFIGURATIONS OF PROCEDURES FOR INPUTTING INFORMATION INTO A SEMI-AUTOMATED INFORMATION PROCESSING SYSTEM. SIXTY USMA PREP SCHOOL ENLISTED MEN WERE GIVEN AN EXPERIMENTAL TASK REQUIRING EACH TO TRANSLATE 35 FREE-TEXT MESSAGES INTO COMPUTER-ACCEPTABLE TERMINOLOGY. ACCURACY AND SPEED OF TWO INPUT PROCEDURES WERE EACH COMPARED UNDER TWO CONDITIONS OF VERIFICATION. IN ONE PROCEDURE, THE SUBJECTS TRANSLATED THE INCOMING MESSAGE ONTO A PAPER FORMAT BEFORE TRANSCRIBING ON THE CRT SCREEN (OFF-LINE). IN THE OTHER PROCEDURE, THE MESSAGE WAS TRANSCRIBED DIRECTLY ON THE CRT SCREEN (ON-LINE). IN THE UNVERIFIED CONDITION, ONE MAN PERFORMED THE INPUT OPERATION WITHOUT ERROR CHECK; IN THE VERIFIED CONDITION, TWO MEN TRANSLATED THE SAME MESSAGE, COMPARED THEIR TRANSLATIONS, AND RESOLVED DIFFERENCES BEFORE ENTERING THE INFORMATION INTO THE DATA BASE. PERFORMANCE RESULTS UNDER THE FOUR EXPERIMENTAL CONDITIONS WERE ALSO COMPARED WITH A SIMILAR 7TH ARMY TOS PROCEDURE IN WHICH A MESSAGE IS TRANSLATED INTO A PAPER FORMAT AND THE UNVERIFIED MESSAGE IS COPIED ON THE CRT SCREEN BY THE UIOD (USER INPUT-OUTPUT DEVICE) OPERATOR.

IN THE PRESENT EXPERIMENT, DATA INPUT ACCURACY WAS SIGNIFICANTLY INCREASED WHEN FREE-TEXT MESSAGES WERE TRANSLATED DIRECTLY ON THE CRT SCREEN RATHER THAN FIRST FILLED OUT ON PAPER FORMATS (11.2% ERROR VS 14.8%). INPUT SPEED WAS PRACTICALLY THE SAME UNDER BOTH METHODS. WHEN TWO OPERATORS CHECKED EACH OTHER'S TRANSLATION BEFORE INPUTTING TO THE DATA BASE, ERROR WAS REDUCED BY ONE-THIRD (10.3% VS 15.7%), BUT THE PROCEDURE REQUIRED ONE-THIRD MORE TIME (6.81 MIN VS 4.98 MIN). EITHER PROCEDURE WAS AN IMPROVEMENT IN ACCURACY OVER THE WORK METHOD USED IN THE TOS. THE PRESENT STUDY STRONGLY SUGGESTS THAT INCOMING MESSAGES SHOULD BE TRANSLATED DIRECTLY ON THE CRT; SCREEN. DIRECT CRT INPUT WOULD REDUCE ERROR WHILE ELIMINATING PAPER FORMATS AND NEED FOR UIOD OPERATOR TRANSCRIPTION. FINDINGS FURTHER SUGGEST THAT, WHEN TIME AND PERSONNEL PERMIT, MESSAGES SHOULD BE VERIFIED FOR CONSISTENCY BEFORE ENTERING THE INFORMATION INTO THE DATA BASE. (A)

## COMMENTS:

THE EXPERIMENT REPORTED IN THIS PAPER WAS DESIGNED AS A 2X2 FACTORIAL. IT IS NOT CLEAR, ON THE BASIS OF THE DESCRIPTION PRESENTED HERE, THAT THIS DESIGN WAS CORRECTLY EMPLOYED OR ANALYZED. IN ONE OF THE VERIFIED DATA ENTRY CONDITIONS, TWELVE PAIRS OF SUBJECTS WERE USED TO DERIVE TWELVE SCORES BUT THE OTHER VERIFIED CONDITION APPARENTLY DERIVED TWELVE SCORES FROM ONLY SIX PAIRS OF SUBJECTS. THIS SUGGESTS THAT EITHER THE EXPERIMENT IS NOT DESCRIBED ACCURATELY OR IS IMPROPERLY ANALYZED. IN ADDITION, ALTHOUGH TIME SCORES FOR DATA ENTRY ARE DISCUSSED, DATA ARE NOT FULLY PRESENTED. A SIMILAR EXPERIMENT, CONCERNED WITH A VARIETY OF TECHNIQUES FOR UNVERIFIED DATA ENTRY IS PRESENTED IN R.T. ROOT AND R. SADACCA (1967).

49D AUTOMATED DATA ENTRY AIDS
STRUB, M.H. AUTOMATED AIDS TO ON-LINE TACTICAL DATA INPUTTING (TECHNICAL
PAPER 262). ARLINGTON, VIRGINIA: U.S. ARMY RESARCH INSTITUTE FOR THE
BEHAVIORAL AND SOCIAL SCIENCES, FEBRUARY 1975. (NTIS NO. AD AC10350)
DESCRIPTION:

AN EXPERIMENT WAS PERFORMED TO EVALUATE A COMPUTER-ASSISTED MESSAGE INPUTTING AID (CAMI) THAT AUTOMATICALLY PRESENTS INFORMATION USEFUL FOR COMPLETING MESSAGE FORMATS. ACCURACY AND SPEED WERE MEASURED USING A CAMI CRT AND A HANDBOOK OF INSTRUCTIONS UNDER BOTH FULL FORMAT AND CHECKLIST FORMAT CONDITIONS. RESULTS WERE COMPARED WITH A CONTROL GROUP THAT WAS PROVIDED A HANDBOOK AND A BLANK-SCREEN CRT. NO SIGNIFICANT DIFFERENCES IN SPEED OR ACCURACY WERE FOUND FOR EITHER THE CAMI AID OR THE CHECKLIST FORMAT. EXAMINATION OF INPUT ERROR DATA INDICATED THAT OVER 80% OF THE TOTAL ERRORS COULD NOT HAVE BEEN DETECTED BY A COMPUTER ERROR-CHECKING ROUTINE. 24P, 6R.

COMMENTS:

THE MESSAGE-PROCESSING TASK USED IN THIS STUDY RESULTED IN VERY HIGH VARIABILITY AND SKEWED DISTRIBUTIONS OF COMPLETION TIMES FOR THE DIFFERENT SUBJECTS. IN VIEW OF THIS HIGH TASK VARIABILITY, THE SAMPLE SIZE WAS ENTIRELY TOO SMALL TO GIVE THE STATISTICAL TESTS ANY DISCRIMINATING POWER. IN FACT, BY EITHER MEAN OR MEDIAN MEASURES, THE CONTROL GROUP, IN WHICH FORMATTED INPUT WAS NOT USED, WAS MORE THAN 40% SLOWER AT THE TASK THAN WERE THE FOUR EXPERIMENTAL CONDITIONS, IN WHICH FORMATTED INPUT WAS USED. ALTHOUGH THE CONSISTENCY OF THE RESULT IS LESS CLEAR, THE TWO GROUPS WHICH FIRST CHECKED THE RELEVANT ITEMS FROM A LIST AND THEN RECEIVED THE SELECTED INPUT FORMATS WERE MORE THAN 20% (BY MEDIAN) SLOWER THAN THOSE INPUTTING DIRECTLY ON INPUT FORMATS. NO DIFFERENCES APPEAR BETWEEN CAMI AND HANDBOOKDIRECTED USERS. ACCURACY SEEMS RELATIVELY UNAFFECTED BY EXPERIMENTAL CONDITION. TO DETERMINE WHETHER THE DIFFERENCES CITED ABOVE ARE "REAL" OR ARE DUE TO SAMPLING ERROR WOULD REQUIRE AN EXPERIMENT WITH MORE SUBJECTS, BUT THE DIFFERENCES ARE SURELY OF SUFFICIENT MAGNITUDE TO BE OF PRACTICAL SIGNIFICANCE. IN PARTICULAR, IT WOULD BE REASONABLE TO SUPPOSE THAT PERFORMANCE ON THIS TASK BENEFITS FROM THE USE OF FORMATTED INPUT AIDS.

491 PERSONALIZED SYSTEMS BASED ON "DECISION STYLE"
STRUB, M.H., & LEVIT, R.A. COMPUTER COMPATIBILITY WITH DECISION STYLE: EDDIES
IN A BIT STREAM. IN PROCEEDINGS OF THE HUMAN FACTORS SOCIETY 18TH ANNUAL
MEETING. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1974, 46-49.
DESCRIPTION:

THE CONCEPT OF DECISION STYLE, WHILE ROOTED IN COGNITIVE AND PERSONALITY THEORY, FINDS APPLICATION IN COMPUTER SYSTEM DESIGN AS A BASIS FOR DECISION AIDING. AS USED IN AN INFORMATION SYSTEM CONTEXT, DECISION STYLE MAY BE DEFINED AS THE CHARACTERISTIC AND SELF CONSISTENT WAY AN INDIVIDUAL USES INFORMATION IN THE DECISION MAKING PROCESS. A MODEL OF DECISION STYLE IS PRESENTED WHICH USES THREE DIMENSIONS TO CLASSIFY EIGHT TYPES OF DECISION STYLES. EACH DIMENSION OF DECISION STYLE CORRESPONDS TO VARIABILITY OBSERVED IN THREE ASPECTS OF DECISION MAKING. A METHODOLOGY FOR THE ASSESSMENT OF DECISION STYLE, AND ITS RELATIONSHIP TO THE CONCEPT OF ADAPTIVE DECISION AIDING, IS PRESENTED. THE CONCEPT OF DECISION SUPPORT AS COMPLEX OF DECISION AIDS DESIGNED WITH REFERENCE TO A DECISION SITUATION PROVIDES THE CONTEXT FOR THE DISCUSSION OF ADAPTIVE AIDING. (A)

COMMENTS:

THIS BRIEF PAPER ASSERTS THAT DECISION MAKERS DIFFER CONSISTENTLY ALONG THREE DIMENSIONS (ABSTRACT-CONCRETE, LOGICAL-INTUITIVE, AND ACTIVE-PASSIVE), AND THAT SUCH DIFFERENCES IN DECISION STYLE CAN BE USED TO OPTIMIZE INFORMATION PRESENTATION FOR INDIVIDUAL DECISION MAKERS. TRAITS ASSOCIATED WITH EXTREME BEHAVIOR ON EACH DIMENSION ARE DISCUSSED, AND POSSIBLE INFORMATION PRESENTATION CORRELATES OF THOSE DIMENSIONS ARE PRESENTED (SYMBOLIC VS. LINGUISTIC, STRUCTURED DATA VS. GLOBAL ASSOCIATIVE DATA, AND PARTIAL VS. COMPLETE DATA, RESPECTIVELY). WHILE THE IDEAS PRESENTED HAVE SOME FACE VALIDITY, NO EVIDENCE IS PRESENTED THAT THE PROPOSED ASSESSMENT PRESENTED ACTUALLY MEASURES DECISION STYLE OR THAT THE PARTICULAR INFORMATION PRESENTATION CORRELATES ARE APPROPRIATE. THIS IS INTERESTING SPECULATION, ALTHOUGH IT MAY BE VERY DIFFICULT TO IMPLEMENT SATISFACTORILY.

492 REVIEW OF LITERATURE ON HUMAN FACTORS IN DISPLAYS
SULLIVAN, D.J., & MEISTER, D. RESEARCH REQUIREMENTS FOR THE HUMAN ENGINEERING
DESIGN OF VISUAL DISPLAYS (TECHNICAL REPORT HOD69-906). CANOGA PARK,
CALIFORNIA: BUNKER-RAMO CORP., DECEMBER 1969. (NTIS NO. AD 701790)
DESCRIPTION:

AS PART OF AN EARLIER STUDY TO DEVELOP A GUIDE TO HUMAN ENGINEERING DESIGN FOR VISUAL DISPLAYS (MEISTER AND SULLIVAN, 1969), A REVIEW WAS MADE OF ALL AVAILABLE LITERATURE (OVER 60D DOCUMENTS) DESCRIBING THE HUMAN FACTORS AFFECTING DISPLAY DESIGN. IN ADDITION TO SERVING AS SOURCE MATERIAL FOR THE HANDBOOK, THE REVIEW WAS MADE TO INDICATE AREAS IN WHICH HUMAN FACTORS RESEARCH ON DISPLAY PARAMETERS WAS LACKING AND SHOULD BE PERFORMED. (A) 31P, 61R.

COMMENTS:

THIS IS A BRIEF, ALTHOUGH FAIRLY THOROUGH, REVIEW OF THE LITERATURE ON HUMAN FACTORS ASPECTS OF VISUAL DISPLAYS. THIS REVIEW SUPPORTS THE AUTHORS' CONCLUSION THAT RESEARCH IS NEEDED IN ALMOST EVERY ASPECT OF VISUAL DISPLAYS. THIS PAPER WOULD BE A GOOD SOURCE OF IDEAS FOR THOSE INTERESTED IN PERFORMING SUCH RESEARCH. A FAIRLY EXTENSIVE BIBLIOGRAPHY OF THIS AREA COVERING 1950 TO 1969 IS ALSO INCLUDED.

493 EXTENDABLE DIALOGUE CAPABILITY OF AESOP SYSTEM SUMMERS, J.K., & BENNETT, E. AESOP: A FINAL REPORT: A PROTOTYPE ON-LINE INTERACTIVE INFORMATION CONTROL SYSTEM. IN D.E. WALKER (ED.), INFORMATION SYSTEM SCIENCE AND TECHNOLOGY: PAPERS PREPARED FOR THE THIRD CONGRESS. WASHINGTON, D.C.: THOMPSON, 1967, 69-86. DESCRIPTION:

AESOP (AN EVOLUTIONARY SYSTEM FOR ON-LINE PROCESSING) IS AN EXPERIMENTAL ON-LINE INFORMATION CONTROL SYSTEM. THE AESOP SYSTEM IS CONCERNED WITH THOSE CATEGORIES OF PROBLEMS THAT CAN BE CHARACTERIZED BY LARGE AMOUNTS OF DATA TO BE STORED, RETRIEVED, PROCESSED, MANIPULATED AND CHANGED. IT SERVES AS A PROTOTYPE FOR A CLASS OF MANAGEMENT OR COMMAND INFORMATION SYSTEMS CAPABLE OF GIVING THE USER AS MUCH ON-LINE CONTROL OVER SYSTEM PERFORMANCE AS POSSIBLE. IT IS A DISPLAY-ORIENTED SYSTEM IN THAT A CATHODE RAY TUBE PROVIDES THE PRIMARY MEANS OF MAN-MACHINE COMMUNICATION. IN A SYSTEM OF THIS ORIENTATION, A LIGHTPEN PROVIDES THE PRIMARY MEANS OF USER CONTROL. THE SYSTEM WAS DESIGNED TO BE USED BY A WIDE RANGE OF USERS AND TO PERMIT SYSTEMS PROGRAMMERS TO CHANGE THE SYSTEM ON-LINE. (A, ABBR.)

COMMENTS:

THE AUTHORS BEGIN WITH THE ASSUMPTION THAT THE DESIGN OF AN EFFECTIVE MAN-MACHINE INTERFACE IS NOT AN EASY TASK. THE SYSTEM DESCRIBED IS EVOLUTIONARY IN THE SENSE THAT THE DESIGN OF A PROPOSED SYSTEM CAPABILITY EVOLVES IN RESPONSE TO USERS REACTIONS. THIS APPEARS TO BE A SOUND DESIGN APPROACH, SO LONG AS THE EXTENDED CAPABILITY IS COMPATIBLE WITH THE BASIC PHILOSOPHY OF THE SYSTEM. THE SOFTWARE ARCHITECTURE OF THIS SYSTEM IS DESCRIBED AND AN EXTENSIVE EXAMPLE OF A MAN-MACHINE DIALOGUE IS PRESENTED. 494 INTERACTIVE DIALOGUE IN BIBLIOGRAPHIC SEARCH SYSTEM
SUMMIT, R.K. DIALOG AND THE USER: AN EVALUATION OF THE USER INTERFACE WITH
A MAJOR ONLINE RETRIEVAL SYSTEM. IN D.E. WALKER (ED.), INTERACTIVE
BIBLIOGRAPHIC SEARCH: THE USER/COMPUTER INTERFACE. MONTVALE, NJ: AFIPS PRESS,
1971, 83-94.
DESCRIPTION:

DIALOG IS THE NAME GIVEN TO AN ONLINE, INTERACTIVE, INFORMATION RETRIEVAL SYSTEM. BY PROVIDING THE USER FULL DISPLAY ACCESS TO THE INDEXING VOCABULARY AND RECURSIVE DEFINITION OF SEARCH EXPRESSIONS, DIALOG BECOMES A DATA PROCESSING EXTENSION OF THE HUMAN OPERATOR WHO DIRECTS AND CONTROLS THE RETRIEVAL PROCESS AS IT CONVERGES ON A RELEVANT SUBSET OF DOCUMENTS. AS A RESULT OF THE VARIETY OF OPERATIONS AVAILABLE IN DIALOG, THE USER WITH A WELL-DEFINED SEARCH TOPIC CAN PROCEED DIRECTLY TO DESIRED RECORDS; THE USER WHO CANNOT SO EXPLICITLY DEFINE HIS SEARCH PRODUCT CAN BROWSE THROUGH THE FILE TO INVESTIGATE SUCCESSIVE AVENUES OF INTEREST AS THEY OCCUR TO HIM, OR AS THEY ARE SUGGESTED BY INTERMEDIATE RETRIEVAL RESULTS. THE SYSTEM CAN BE LEARNED IN MINUTES AND HAS BEEN SUCCESSFULLY USED BY A VARIETY OF PERSONNEL. (A)

COMMENTS:

THE THESIS OF THIS PAPER IS THAT AN INTERACTIVE RETRIEVAL SYSTEM SHOULD FUNCTION AS A "DATA PROCESSING EXTENSION OF THE USER." THIS IMPLIES, AS THE AUTHOR NOTES, THAT THE SYSTEM SHOULD BE RESPONSIVE TO INDIVIDUAL DIFFERENCES IN USER NEEDS AND TO INDIVIDUAL DIFFERENCES IN THE APPROACH TO A PROBLEM. ALLOWING THE USER TO DYNAMICALLY DEFINE SEARCH CATEGORIES BY LOGICALLY COMBINING INDIVIDUAL CATEGORIES AIDS IN ACHIEVING THESE GOALS. A SIMILAR APPROACH, WHICH MAY RESULT IN FASTER AND MORE ECONOMICAL SEARCHES ON LARGE DATA BASES, HAS BEEN PROPOSED BY D.U. WILDE (1969).

495 EVALUATION OF MANUAL CONTROL DISPLAYS
SUN, P.B., & DUKES, T.A. A METHOD FOR THE EVALUATION OF INTEGRATED DISPLAYS
IN MANUAL CONTROL SYSTEMS. IN PROCEEDINGS OF THE 1972 INTERNATIONAL CONFERENCE
ON CYBERNETICS AND SOCIETY. NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS
ENGINEERS, INC., 1972, 177-182.
DESCRIPTION:

A NEW EXPERIMENTAL METHOD IS INTRODUCED FOR THE EVALUATION AND TRADE-OFF STUDIES OF DISPLAY AND DYNAMICS CHARACTERISTICS IN MULTI-VARIABLE MAN-MACHINE SYSTEMS. THE DEPENDENT TEST VARIABLES ARE AUTOMATICALLY ADJUSTED SYSTEM PARAMETERS, WHILE THE DISTURBANCE AND ERROR LEVELS ARE PRESCRIBED. A SERIES OF THREE-VARIABLE EXPERIMENTS APPROXIMATING THE POSITIONING CONTROL OF A HOVERING VEHICLE IS DESCRIBED. THE RESULTS ARE EXPRESSED IN TERMS OF A PERFORMANCE MEASURE THAT CAN BE ASSOCIATED WITH FEEDBACK AUGMENTATION REQUIREMENTS NEEDED TO PERFORM A GIVEN TASK. THE RESULTS SHOW THE SENSITIVITY OF THE PERFORMANCE MEASURE TO THE NUMBER OF CONTROL LOOPS AND TO THE PRESCRIBED ERROR LEVELS. THE UTILIZATION OF THE METHOD FOR TRADE-OFF STUDIES BETWEEN DISPLAY AND SYSTEM PARAMETERS IS ALSO DEMONSTRATED. (A) 6P, 10R.

COMMENTS:

THIS APPEARS TO BE A FAIRLY STANDARD APPROACH TO EVALUATING MANUAL CONTROL SYSTEMS, IN THAT CRITERIA ARE DEFINED AND SYSTEM RESPONSES ARE MANIPULATED IN ORDER TO MAXIMIZE THESE CRITERIA. THE ONLY NEW FEATURE IS THE AUTOMATIC ADJUSTMENT OF SYSTEM PARAMETERS IN RESPONSE TO OPERATOR PERFORMANCE. A DIFFERENT APPROACH, WHICH BEGINS WITH OBSERVED RESPONSES AND ATTEMPTS TO DETERMINE THE CRITERIA OPTIMIZED IS PRESENTED IN E.M. CONNELLY (1977).

496 THREE-DIMENSIONAL GRAPHICAL INPUT
SUTHERLAND, 1.E. THREE-DIMENSIONAL DATA INPUT BY TABLET. PROCEEDINGS OF THE
IEEE, 1974, 62, 453-461.
DESCRIPTION:

A LARGE-AREA MULTIPLE-PEN TABLE SYSTEM FOR THREE-DIMENSIONAL DATA INPUT IS DESCRIBED. THE LARGE TABLET AREA PROVIDES SPACE FOR SIMULTANEOUS USE OF SEVERAL VIEWS OF THE THREE-DIMENSIONAL OBJECT BEING DIGITIZED. THE MULTIPLE PENS ENABLE THE USER TO INDICATE A SINGLE POINT SIMULTANEOUSLY IN TWO SUCH VIEWS, THUS DEFINING THE THREE-DIMENSIONAL POSITION OF THE POINT.

FIVE SIGNIFICANT TECHNIQUES ARE OUTLINED. FIRST, THE LARGE-AREA DIGITIZING SURFACE WITH MULTIPLE PENS HAS PROVED TO BE AN INSTRUMENT VERY DIFFERENT FROM THE MORE FAMILIAR SINGLE-PEN SMALL TABLETS. SECOND, A PAIR OF TWO-DIMENSIONAL POSITIONS IS CONVERTED INTO A FOUR-DIMENSIONAL SPACE AND THEN BACK TO THREE DIMENSIONS. THIRD, THE SPECIFICATION OF VIEW AREAS, VIEWING DIRECTIONS, VIEW POSITIONS, AND COORDINATE AXIS IS ACCOMPLISHED BY GIVING EXAMPLES DIRECTLY IN THE VIFILING SPACE DATHER THAN BY SECRETARING.

VIEWING DIRECTIONS, VIEW POSITIONS, AND COORDINATE AXIS IS ACCOMPLISHED BY GIVING EXAMPLES DIRECTLY IN THE VIEWING SPACE RATHER THAN BY SPECIFYING ABSTRACT VIEWING PARAMETERS. FOURTH, AN ATTITUDE ABOUT COORDINATE CONVERSION USING THE INVERSE OF A BASIS MATRIX IS USED THROUGHOUT WHICH AUTOMATICALLY COMPENSATES FOR ANY TILT IN THE VIEWS ON THE TABLET SURFACE AND ANY NONPERPENDICULARITY OF THE TABLET AXIS. FIFTH, THE MATHEMATICS OF CONVERTING FROM PAIRS OF PERSPECTIVE VIEWS OR PAIRS OF PHOTOGRAPHS, WHILE NOT NEW, IS FORMULATED SIMPLY IN AN APPENDIX WITH SEVERAL EXAMPLES. (A) 8P, 10R.

COMMENTS:

THIS PAPER DESCRIBES AN INTERESTING AND SOPHISTICATED TECHNIQUE FOR THREE-DIMENSIONAL DATA INPUT. AS THE AUTHOR NOTES, TECHNIQUES FOR COMPUTER GENERATION OF THREE-DIMENSIONAL OBJECTS ARE FAIRLY ADVANCED, BUT TECHNIQUES THAT ALLOW THE USER TO ENTER SUCH INPUT ARE, BY COMPARISON, FAIRLY PRIMITIVE. THE TECHNIQUE DISCUSSED IN THIS PAPER APPEARS TO BE BOTH EFFECTIVE AND FAIRLY EASY TO USE, AT LEAST FOR THE EXPERIENCED USER. NO DISCUSSIONS OF USER ACCEPTANCE OR EXPERIENCES, HOWEVER, ARE PRESENTED. THE MAJOR SECTIONS OF THIS PAPER CONCENTRATE ON THE MECHANICS OF USING THIS SYSTEM AND THE UNDERLYING MATHEMATICAL TRANSFORMATIONS FOR CONVERTING FROM TWO-DIMENSIONAL INPUT TO THREE-DIMENSIONAL OUTPUT.

497 INTERACTIVE DATA ORGANIZATION AND ANALYSIS
SWERDLOW, S.G. INTERACTIVE DATA REDUCTION IN PLANNING. IN H. SACKMAN & R.L.
CITRENBAUM (EDS.), ONLINE PLANNING: TOWARDS CREATIVE PROBLEM SOLVING.
ENGLEWOOD CLIFFS, NEW JERSEY: PRENTICE-HALL, 1972, 365-384.
DESCRIPTION:

ALTERNATIVE DESIGN FEATURES IN INTERACTIVE DATA REDUCTION SYSTEMS ARE STUDIED BY EXAMINING SEVERAL SYSTEMS DISCUSSED IN THE LITERATURE. ESSENTIAL FACTORS INVOLVED IN THOSE DESIGNS ARE EXTRACTED BY CROSS COMPARING THE SYSTEMS. A RATING IS MADE OF THE IMPORTANCE OF THESE FACTORS IN THE CONTEXT OF INTERACTIVE DATA REDUCTION IN SUPPORT OF PLANNING. LOW-LEVEL INTERACTIONS AMONG THEM ARE CONSIDERED. THE DETAILED RATINGS ARE PRESENTED IN A SERIES OF TABLES. GENERAL ASPECTS OF THESE TABLES ARE DISCUSSED IN THE TEXT.

OVERALL CONCLUSIONS ARRIVED AT ARE: FIRST, THAT INTERACTIVE DATA REDUCTION IS MOST USEFUL AS A TOOL FOR PLAYING WITH DATA OR MODELS. THIS MEANS EXAMINING THE UNDERLYING STRUCTURE TO DETERMINE THE MOST LIKELY HYPOTHESIS THAT THE DATA CAN SUPPORT OR REJECT. THE HEAVY COMPUTING REQUIRED FOR TESTING THE HYPOTHESIS SHOULD BE PERFORMED OFFLINE. SECOND, IDENTIFICATION OF THE USER CLASS FOR WHICH THE SYSTEM IS BEING DESIGNED IS THE MOST CRITICAL FACTOR IN DESIGN DECISIONS. THIS CONCLUSION IMPLIES THAT A GENERAL PURPOSE SYSTEM MAY NOT BE DESIRABLE. THIRD, SOME ADVANCED FEATURES WHICH THE ULTIMATE USER CLASS MAY NOT REQUIRE WILL HAVE TO BE IMPLEMENTED IN ORDER TO SUPPORT PROGRAM DEVELOPMENT. (A)

20P, 7R.

THIS PAPER CONTAINS A CONCISE AND EASY TO READ INTRODUCTION TO INTERACTIVE DATA REDUCTION SYSTEMS. THE AUTHOR DISCUSSES SOME OF THE DESIGN CHOICES AVAILABLE TO DESIGNERS AND THE RELATION BETWEEN THESE CHOICES AND THE POTENTIAL USERS OF THE SYSTEM. ALTHOUGH TECHNIQUES FOR CLASSIFYING USERS' ABILITIES OR FOR DETERMINING USER REQUIREMENTS ARE NOT CONSIDERED, EXAMPLES OF HOW THESE FACTORS SHOULD AFFECT THE DESIGN OF SYSTEMS FOR PLANNING APPLICATIONS ARE PRESENTED. ALTHOUGH THIS IS AN INTRODUCTORY LEVEL PAPER, IT CONTAINS SEVERAL USEFUL IDEAS ABOUT SYSTEM DESIGN.

USER REQUIREMENTS ANALYSIS

TAGGART, W.M., JR., & THARP, M.O. A SURVEY OF INFORMATION REQUIREMENTS ANALYSIS TECHNIQUES. COMPUTING SURVEYS, 1977, 9, 273-290. DESCRIPTION:

A RECENT NATIONAL STUDY ESTABLISHED "THE IDENTIFICATION OF INFORMATION NEEDS OF MANAGEMENT" AS A MOST CRITICAL FACTOR IN SUCCESSFUL MIS IMPLEMENTATION. THIS SURVEY COVERS A VARIETY OF APPROACHES TO THE DETERMINATION OF INFORMATION NEEDS SUGGESTED DURING THE PAST DECADE. PRESENTATION HAS TWO OBJECTIVES: (1) TO REVIEW AVAILABLE INFORMATION ANALYSIS METHODS WITH A DETAILED LOOK AT SEVERAL APPROACHES; AND (2) TO SUGGEST RESEARCH DIRECTIONS TO IMPROVE THE USEFULNESS OF THESE METHODS. 18P, 29R.

COMMENTS:

THIS PAPER IS DIVIDED INTO TWO PRIMARY SECTIONS. THE SECOND SECTION CONTAINS A BIBLIOGRAPHY OF SELECTED PAPERS ON REQUIREMENTS ANALYSIS FOR MANAGEMENT INFORMATION SYSTEMS AND THE FIRST SECTION DESCRIBES HOW PAPERS WERE SELECTED FOR INCLUSION IN THIS BIBLIOGRAPHY. BASED ON AN ARBITRARY RATING OF PAPERS WITH RESPECT TO SEVERAL ASPECTS OF MANAGEMENT INFORMATION REQUIREMENTS ANALYSIS, THE AUTHORS DETERMINED THAT THE SURVEYED METHODS FALL INTO SIX GROUPS, ALTHOUGH THE COMMONALITIES OF THESE GROUPS ARE NOT DESCRIBED. ONE PAPER FROM EACH GROUP WAS SELECTED FOR FAIRLY EXTENSIVE ANNOTATION AND THE REMAINING PAPERS ARE GIVEN BRIEFER CONSIDERATION IN THE BIBLIOGRAPHY. ALTHOUGH THIS BIBLIOGRAPHY IS FAIRLY SHORT, IT DOES PROVIDE USEFUL DISCUSSIONS OF THE PAPERS INCLUDED. RECOMMENDATIONS FOR FURTHER RESEARCH ARE ALSO MADE.

499 DATA ENTRY

TALBOT, J.E. THE HUMAN SIDE OF DATA INPUT. DATA PROCESSING MAGAZINE, APRIL 1971, 13(4), 28-35.

DESCRIPTION:

ONCE THE COMPUTER LATCHES ONTO DATA IN BINARY FORM IT GENERALLY PROCESSES AND TRANSMITS THIS DATA ACCURATELY. MOST ERRORS ARE BORN AT THE INTERFACE WHERE MAN (OR WOMAN) MEETS MACHINE. THIS ARTICLE ROUNDS UP SOME OF THE HUMAN FACTORS ASSOCIATED WITH POPULAR DATA INPUT SYSTEMS. (A)

THE INPUT SYSTEMS CONSIDERED INCLUDE VARIOUS TYPES OF KEYBOARD DEVICES, OPTICAL CHARACTER RECOGNIZERS, DIRECT DATA ENTRY TERMINALS AND POINT OF SALE TERMINALS.

8P, OR.

THIS PAPER PROVUES A NON-TECHNICAL, EASY TO READ DISCUSSION OF VARIOUS DATA ENTRY DEVICES AND SOME OF THE HUMAN FACTORS ASPECTS ASSOCIATED WITH THESE DEVICES. ALTHOUGH THIS PAPER WOULD NOT BE RELEVANT TO THOSE WHO WISH A TECHNICAL DISCUSSION OF THIS AREA, IT DOES PROVIDE A GOOD INTRODUCTION TO THIS AREA AND WOULD BE ESPECIALLY USEFUL TO SUPERVISORY PERSONNEL IN DATA ENTRY OPERATIONS.

AUTOMATED MEDICAL HISTORIES TATHAM, L. SAY 110001. DATA SYSTEMS, JULY 1970, 30-31. DESCRIPTION:

THIS PAPER BRIEFLY DESCRIBES A SYSTEM DESIGNED FOR USE IN AUTOMATED MEDICAL INTERVIEWS. THIS SYSTEM WAS DESIGNED TO FULFILL TWO OBJECTIVES -- TO DETERMINE HOW AN EFFECTIVE INTERFACE BETWEEN THE COMPUTER AND THE GENERAL PUBLIC COULD BE ACHIEVED AND TO HANDLE SOME OF THE WORK NORMALLY CARRIED OUT BY A MEDICAL CONSULTANT. EXPERIENCE WITH THIS SYSTEM DEMONSTRATES THAT HUMANS ARE EXTREMELY ADAPTABLE IN THEIR BEHAVIOR AND THAT THE NEEDS OF THE PEOPLE THAT WILL USE IT MUST BE CONSIDERED IF AN EFFECTIVE MAN-MACHINE INTERFACE IS TO BE DEVELOPED.

2P, OR.

THE SYSTEM DISCUSSED HERE IS DESCRIBED IN GREATER DETAIL IN W.I. CARD, M. NICHOLSON, G.P. CREAN, G. WATKINSON, C.R. EVANS, J. WILSON, AND D. RUSSELL (1974). ALTHOUGH THIS PAPER PROVIDES A BRIEF, EASILY READ INTRODUCTION TO THIS RESEARCH, THOSE WISHING A MORE SUBSTANTIVE DISCUSSION SHOULD CONSULT THE LATTER PAPER.

501 AUTOMATED SPEECH GENERATION
TATHAM, M.A.A. SPEECH SYNTHESIS: A CRITICAL REVIEW OF THE STATE OF THE ART.
INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1970, 2, 303-308.
DESCRIPTION:

THE PRESENT PAPER IS DIVIDED INTO THREE PARTS: (A) THE SYNTHESIZER, (B) CONTROL OF THE SYNTHESIZER AND (C) USE OF SYNTHESIZERS. THERE IS NO ATTEMPT TO GIVE A DETAILED ACCOUNT OF THE HISTORY OF SPEECH SYNTHESIS (FOR THIS, SEE: FLANAGAN, 1965 AND MATTINGLY, 1968), NOR ANY ACCOUNT OF THE DETAILS OF COMPUTER PROGRAMMING FOR THE CONTROL OF SYNTHESIZERS: WHAT THIS PAPER IS MAINLY CONCERNED WITH ARE THE STRATEGIES INVOLVED IN WHAT HAS BECOME KNOWN AS "RULE SYNTHESIS" AND THE EFFECT OF THESE ON THE USE TO WHICH SPEECH SYNTHESIS MIGHT BE PUT. (A)

COMMENTS:

THIS PAPER PROVIDES A BRIEF INTRODUCTION TO THE BASIC TYPES OF SPEECH SYNTHESIZERS. THE AUTHOR NOTES THAT THE MOST IMPORTANT CRITERION FOR A SPEECH SYSTEM FOR MAN-COMPUTER COMMUNICATION IS WHETHER THE SYSTEM WORKS AND NOT WHETHER THE SYSTEM IS BASED ON VIABLE THEORIES OF HUMAN SPEECH PERCEPTION AND PRODUCTION. HE ARGUES, HOWEVER, THAT IT MAY BE IMPOSSIBLE TO DEVELOP A FUNCTIONING SYSTEM WITHOUT TAKING LINGUISTIC THEORY INTO ACCOUNT.

502 GENERAL DISCUSSION OF INTERACTIVE SYSTEMS
TAYLOR, R.W. MAN-COMPUTER INPUT-OUTPUT TECHNIQUES. IEEE TRANSACTIONS ON
HUMAN FACTORS IN ELECTRONICS, 1967, HFE-8, 1-4.
DESCRIPTION:

THIS PAPER DISCUSSES SOME PROBLEMS OF TERMINOLOGY CONCERNING MULTIPLE-ACCESS, ON-LINE, INTERACTIVE MAN-COMPUTER SYSTEMS. IN ADDITION, THREE VIEWPOINTS FROM WHICH MAN-COMPUTER INTERACTION CAN BE APPROACHED ARE DESCRIBED: INTERNAL REPRESENTATION OF INFORMATION, SURFACE STRUCTURE, AND GENERAL CHARACTERISTICS OF PROBLEMS TO BE SOLVED.

4P, 8R.

COMMENTS:

THIS PAPER WAS INTENDED PRIMARILY AS AN INTRODUCTION TO A SPECIAL ISSUE OF THE JOURNAL DEVOTED TO MAN-COMPUTER INTERACTION. IT CONTAINS A BRIEF STATEMENT OF THE AUTHOR'S VIEW OF THE STATE OF THE ART AT THE TIME, BUT IS PROBABLY NOT OF GENERAL INTEREST NOW.

503 GENERAL DISCUSSION OF INTERACTIVE SYSTEMS
TAYLOR, R.W. ON THE RELATION OF INTERACTIVE COMPUTING TO COMPUTER SCIENCE.
PROCEEDINGS OF THE IEEE, 1975, 63, 843-846.
DESCRIPTION:

RECOGNITION OF COMPUTER SCIENCE AS A RESEARCH AND EDUCATIONAL FIELD IN ITS OWN RIGHT BEGAN ONLY A DECADE AGO. THE COMPUTER SCIENCE MAINSTREAM HAS BEEN FOCUSED UPON THE UNDERSTANDING AND CREATION OF DISCOURSE BETWEEN HUMANS AND, MORE SPECIFICALLY, BETWEEN HUMANS AND THEIR INFORMATIONAL RESOURCES, BOTH HUMAN AND MACHINE. THIS IS IN CONTRAST WITH THE COMMON AND PREDOMINATE INSTITUTIONAL VIEW THAT THE COMPUTER IS AN ARITHMETIC ENGINE. THE PRESENT AND POTENTIAL INFORMATIONAL RESOURCES VALUABLE TO A HUMAN REQUIRE LITTLE CONCERN FOR ARITHMETIC. THE HUMAN VALUE OF INFORMATIONAL RESOURCES RESULTS THROUGH AIDING THE HUMAN'S ABILLTY TO EXTERNALIZE MODELS OF ISSUES, THINGS, OR EVENTS, I.E., THE KEY TO UNDERSTANDING AND THEN COMMUNICATING. INTERACTIVE COMPUTING ISSUES WILL CONTINUE TO BE THE DRIVING FORCE OF COMPUTER SCIENCE RESULTING IN EVENTUAL COMMON AWARENESS THAT THE COMPUTER IS A POPULIST COMMUNICATIONS MEDIUM. (A)

4P, 13R. COMMENTS:

THIS IS A GENERAL, PHILOSOPHICAL DISCUSSION OF THE EFFECTS OF TIME-SHARING, ARTIFICIAL INTELLIGENCE, AND OTHER MODERN DEVELOPMENTS ON OUR VIEW OF THE RELATIONSHIP BETWEEN MAN AND COMPUTER. THE AUTHOR SEEMS PARTICULARLY INTERESTED IN CORRECTING THE VIEW, NO LONGER TENABLE, THAT "NUMBER CRUNCHING" REPRESENTS THE MOST EFFECTIVE USE OF COMPUTERS. THE CONTENT IS VERY GENERAL, BUT MAY BE USEFUL INTRODUCTORY MATERIAL FOR NONSPECIALIST READERS.

504 COLOR CODING

TEICHNER, W.H., CHRIST, R.E., & CORSO, G.M. COLOR RESEARCH FOR VISUAL DISPLAYS (REPORT NO. ONR-CR213-102-4F). LAS CRUCES, NEW MEXICO: NEW MEXICO STATE UNIVERSITY, DEPARTMENT OF PSYCHOLOGY, JUNE 1977. (NTIS NO. AD AD43609) DESCRIPTION:

THIS REPORT PRESENTS THE RESULTS OF THREE COMPLEX MULTIPLE TASK EXPERIMENTS INTENDED TO COMPARE THE EFFECTIVENESS OF COLOR CODING IN VISUAL DISPLAYS AGAINST CODING BY ACHROMATIC LETTERS, DIGITS, AND SHAPES. THE RESULTS OF THESE THREE EXPERIMENTS ARE THEN INTEGRATED WITH PREVIOUSLY REPORTED RESEARCH TO PROVIDE A COMPREHENSIVE ASSESSMENT OF THE POTENTIAL ADVANTAGES AND DISADVANTAGES OF COLOR CODING. (A)

THE PRINCIPAL RESULT IS THAT COLOR CODING DOES NOT AFFECT PERFORMANCE DIFFERENTLY THAN THE ACHROMATIC CODES USED, WITH THE EXCEPTION OF A REAL CODING. THE MOST EFFECTIVE APPLICATIONS FOR COLOR CODING ARE: (1) DESIGNATING A SPECIFIC TARGET IN A CROWDED DISPLAY, (2) DEMARCATING AN AREA OF A DISPLAY, (3) PROVIDING WARNING SIGNALS OR COMMANDS WHICH HAVE A LIMITED NUMBER OF POSSIBLE ALTERNATIVES, AND (4) CLASSIFYING OR GROUPING DATA WHERE THE NUMBER OF CLASSIFICATIONS ARE SMALL.

COMMENTS:

THIS IS AN EXCELLENT DISCUSSION AND ANALYSIS OF COLOR CODING. THE AUTHORS DESCRIBE SOME GENERAL PRINCIPLES OF HUMAN INFORMATION PROCESSING THAT RELATE TO COLOR CODING, USE THESE PRINCIPLES TO DERIVE POSSIBLE ADVANTAGES AND DISADVANTAGES OF COLOR CODING, AND DESCRIBE THREE EXPERIMENTS. THESE EXPERIMENTS APPEAR TO HAVE BEEN APPROPRIATELY DESIGNED AND CAREFULLY CONDUCTED. THE CONCLUSION THAT COLOR CODING DOES NOT DIFFER FROM ANY OTHER FORM OF CODING, AT LEAST IN THE CONTEXT OF THESE EXPERIMENTS, IS WELL-FOUNDED. THE DISCUSSION OF INFORMATION PROCESSING PRINCIPLES WOULD PROVIDE A GOOD FRAMEWORK FOR THOSE INTERESTED IN RESEARCH ON COLOR CODING.

505 COMPUTER AIDS FOR PROGRAMMING

TEITELMAN, W. "DO WHAT I MEAN": THE PROGRAMMER'S ASSISTANT. COMPUTERS AND AUTOMATION, APRIL 1972, 21(4), 8-11.
DESCRIPTION:

THIS ARTICLE DEALS WITH THE DESIGN AND ACTUAL IMPLEMENTATION IN A COMPUTER PROGRAMMING SYSTEM OF "A PROGRAMMER'S ASSISTANT". THE GENERAL FUNCTION OF THE "PROGRAMMER'S ASSISTANT" IS TO MAKE IT POSSIBLE FOR THE HUMAN PROGRAMMER TO SAY TO THE COMPUTER "DO WHAT I MEAN" INSTEAD OF "DO WHAT I SAY," AND "UNDO WHAT I JUST TRIED -- IT DID NOT WORK," INSTEAD OF LEAVING THE PROGRAMMER WITH THE SAD CONSEQUENCES OF HIS ACTUAL INSTRUCTIONS.

IN OTHER WORDS, THE PROGRAMMER'S ASSISTANT DEALS WITH SUCH FACTORS AS:
EASE OF INTERACTION, LEVEL OF INTERACTION, FORGIVENESS FOR ERRORS (BOTH
SPELLING ERRORS AND ERRORS OF THOUGHT), GOING BACK AND TAKING A DIFFERENT
PATH, CHANGING ONE'S MIND, ETC., AND IN GENERAL, THE PROGRAMMER'S
ENVIRONMENT.

THIS AREA OF IMPROVEMENT IN INTERACTIVE PROGRAMMING IS IMPORTANT. FOR MANY APPLICATIONS, THE PROGRAMMER'S ENVIRONMENT INFLUENCES, AND TO A LARGE EXTENT DETERMINES, WHAT SORT OF PROBLEM HE CAN TACKLE, AND HOW FAR HE CAN GO IN A GIVEN TIME. IF THE "ENVIRONMENT" IS "COOPERATIVE" AND "HELPFUL," THEN THE PROGRAMMER CAN BE MORE AMBITIOUS AND PRODUCTIVE. IF NOT, HE MAY SPEND MUCH OF HIS TIME AND ENERGY PERFORMING ROUTINE CLERICAL TASKS AND "FIGHTING THE SYSTEM." (A)

4P, 3R. COMMENTS:

THIS PAPER PRESENTS A BRIEF DESCRIPTION OF THE DWIM (DO WHAT I MEAN)
CAPABILITY IN AN INTERACTIVE SYSTEM. THE FEATURES OF DWIM INCLUDE AUTOMATIC
ERROR CORRECTION AND THE ABILITY TO UNDO PREVIOUS USER ACTIONS OR COMMANDS.
IN EFFECT, DWIM ACTS AS AN INTERFACE BETWEEN THE USER AND THE COMPUTER
SYSTEM AND SERVES TO CREATE A MORE EFFECTIVE INTERFACE. SOME THOUGHT,
HOWEVER, SHOULD BE GIVEN TO THE TYPES OF ACTIONS FOR WHICH SUCH A SYSTEM
ATTEMPTS TO DETERMINE THE USER'S INTENTIONS, AS OPPOSED TO CARRYING OUT HIS
STATED COMMANDS. FOR EXAMPLE, ALTHOUGH SYNTACTIC ERRORS CAN BE DETECTED
AND CORRECTED FAIRLY ACCURATELY, SHOULD THE SYSTEM ALSO ATTEMPT TO CORRECT
WHAT IT PERCEIVES AS LOGICAL ERRORS?

506 GENERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
TESTA, C.J. BEHAVIORAL FACTORS IN INFORMATION SYSTEMS. COMPUTERS AND PEOPLE,
APRIL 1974, 23(4), 13-17.
DESCRIPTION:

THE NEED FOR BETTER UNDERSTANDING OF HUMAN BEHAVIOR IN INFORMATION SYSTEMS IS BECOMING INCREASINGLY APPARENT. TRADITIONALLY, INFORMATION SPECIALISTS HAVE CONCENTRATED THEIR EFFORTS ON HARDWARE/SOFTWARE PROBLEMS. AS A RESULT, SOPHISTICATED INFORMATION SYSTEMS WERE OFTEN DEVELOPED, BUT PEOPLE EXPERIENCED DIFFICULTY IN INTERACTING WITH THE COMPLEX SYSTEMS. SINCE INFORMATION SYSTEMS ARE USED, OPERATED, AND MAINTAINED BY PEOPLE, THE DESIGN OF EFFECTIVE INFORMATION SYSTEMS WILL ONLY RESULT IF MEN'S BEHAVIORAL CAPABILITIES ARE TAKEN INTO CONSIDERATION. IN THIS ARTICLE, MAN'S PERCEPTUAL AND COGNITIVE CAPABILITIES WILL BE EXAMINED AS IMPORTANT DETERMINANTS OF THE DESIGN OF INFORMATION SYSTEMS. (A, ABBR)

SP, 12R. COMMENTS:

THE MOST IMPORTANT CONTRIBUTION OF THIS PAPER IS THAT IT ARGUES THAT PSYCHOLOGICAL CONCEPTS AND THEORIES CAN USEFULLY BE APPLIED TO THE DEVELOPMENT OF INFORMATION SYSTEMS. IN RECENT YEARS, A GREAT DEAL OF RESEARCH IN COGNITIVE PSYCHOLOGY HAS BEEN DIRECTED AT DETERMINING HUMAN INFORMATION PROCESSING ABILITIES AND LIMITATIONS AND IT IS REASONABLE TO EXPECT THAT THE RESULTS OF RESEARCH COULD PROVIDE VALUABLE INSIGHTS INTO THE DESIGN OF INFORMATION SYSTEMS. THE AUTHOR IGNORES THIS RESEARCH, HOWEVER, AND CONSIDERS THE AREAS OF PERCEPTION, PSYCHOTHERAPY, AND PERSONALITY. ALTHOUGH THESE AREAS MAY BE RELEVANT, THEY ARE NOT AS APPROPRIATE OR USEFUL AS THE AREA OF INFORMATION PROCESSING.

TAXONOMY OF HUMAN PERFORMANCE
THEOLOGUS, G.C., ROMASHKO, T., & FLEISHMAN, E.A. DEVELOPMENT OF A TAXONOMY
OF HUMAN PERFORMANCE: A FEASIBILITY STUDY OF ABILITY DIMENSIONS FOR
CLASSIFYING HUMAN TASKS (TECHNICAL REPORT NO. 5). WASHINGTON, D.C.: AMERICAN
INSTITUTES FOR RESEARCH, JANUARY 1970. (JSAS MS. NO. 321)
DESCRIPTION:

A MAJOR PROBLEM WHICH CONFRONTS THE BEHAVIORAL SCIENCES IS THE LACK OF A UNIFYING SET OF DIMENSIONS FOR DESCRIBING HUMAN TASK PERFORMANCE. ABSENCE OF SUCH A SYSTEM LIMITS THE ABILITY TO RELATE HUMAN PERFORMANCE OBSERVED IN ONE TASK TO THAT OBSERVED IN SIMILAR TASKS. THERE IS A NEI FOR A WELL-DEFINED TASK-DESCRIPTIVE LANGUAGE FOR USE BY THOSE WHO MUST THERE IS A NEED APPLY THE RESULTS OF RESEARCH TO OPERATIONAL TASKS. THIS REPORT DESCRIBES ONE OF SEVERAL APPROACHES UNDER DEVELOPMENT AS PART OF A LARGER PROGRAM; THE APPROACH IS CONCERNED WITH DEVELOPING A TASK CLASSIFICATION SYSTEM BASED UPON KNOWN PARAMETERS OF HUMAN PERFORMANCE. THE HUMAN ABILITIES, UPON WHICH THIS SYSTEM WAS BASED, WERE DERIVED PRIMARILY FROM THE REPORTED FACTOR ANALYSES OF HUMAN PERFORMANCE IN THE COGNITIVE, PSYCHOMOTOR, PHYSICAL, PERCEPTUAL, AND SENSORY AREAS. DEFINITIONS OF THE ABILITIES WERE DEVELOPED TOGETHER WITH RATING SCALES FOR EACH ABILITY. A SERIES OF PILOT STUDIES WERE THEN UNDERTAKEN WITH THE OBJECTIVE OF PRODUCING AN INSTRUMENT WHICH WOULD HAVE HIGH RELIABILITY IN CLASSIFYING HUMAN TASKS. DURING THESE EXPLORATORY STUDIES, THE INITIAL SET OF HUMAN ABILITIES WAS MODIFIED, THE DEFINITIONS OF THE ABILITIES WERE REVISED, AND THE RATING TECHNIQUE WAS IMPROVED UPON. IN ADDITION, THE STUDIES EXAMINED VARIOUS METHODS OF ANALYZING THE RELIABILITY DATA, AND COMPARED TWO METHODS OF ANCHORING THE RATING SCALES. THE RESULTS OF THIS PILOT RESEARCH INDICATED THAT IT WAS POSSIBLE TO DEVELOP A SET OF RELIABLE, ABILITY-BASED SCALES FOR CLASSIFYING TASKS, ALTHOUGH MORE WORK WILL BE NEEDED. FUTURE RESEARCH ON A HUMAN ABILITY APPROACH TO CLASSIFICATION WILL CONTINUE WITH THE INVESTIGATION OF THE PROBLEMS OF SCALE RELIABILITY AND WILL IMITATE RESEARCH ON QUESTIONS OF THE VALIDITY OF THE CLASSIFICATORY INSTRUMENT. 213P, 25R.

COMMENTS:

THIS IS A WELL-WRITTEN, DETAILED REPORT OF TWO PILOT STUDIES IN CLASSIFYING TASKS. THESE STUDIES WERE CAREFULLY DESIGNED AND CONDUCTED. ALTHOUGH THE RESULTS OF SUCH RESEARCH HAVE DEVIOUS BENEFITS TO PERSONNEL SELECTION AND TRAINING, THERE MAY BE BENEFITS TO THE DESIGN OF THE MAN-COMPUTER INTERFACE. SPECIFICALLY, AN ANALYSIS OF THE HUMAN ABILITIES INVOLVED IN A GIVEN TASK WOULD AID IN DETERMINING WHAT INTERFACE PARMETERS ARE MOST COMPATIBLE WITH THE ABILITIES AND, THEREFORE, INCREASE OVERALL SYSTEM PERFORMANCE.

508 QUANTIFIERS IN QUERY LANGUAGES
THOMAS, J.C. QUANTIFIERS AND QUESTION-ASKING (TECHNICAL REPORT NO. RC 5866).
YORKTOWN HEIGHTS, NEW YORK: IBM WATSON RESEARCH CENTER, FEBRUARY 1976.
DESCRIPTION:

DATA CONCERNING THE USE OF UNIVERSAL QUANTIFIERS IN QUESTION-ASKING IS PRESENTED. THESE DATA WERE COLLECTED IN A VARIETY OF PROCEDURES USING NON-PROGRAMMERS. THESE NON-PROGRAMMERS VARIOUSLY TRANSLATED ENGLISH QUESTIONS INTO A QUERY LANGUAGE, GENERATED THEIR OWN ENGLISH QUESTIONS, TRANSLATED VENN DIAGRAMS INTO ENGLISH OR VICE VERSA, GAVE JUDGMENTS ABOUT THE CONSISTENCY OF TWO ENGLISH STATEMENTS, OR MANUALLY LOOKED UP ANSWERS TO QUESTIONS. SUBJECTS SHOWED CONSIDERABLE DIFFICULTY WITH THE LOGICIAN'S NOTATIONS OF SET RELATIONS (EXCEPT DISJUNCTION) ON ALL TASKS. THE INTERPRETATIONS GIVEN QUANTIFIED SENTENCES VARIED BETWEEN SUBJECTS ON A GIVEN TASK AND EVEN WITHIN A SUBJECT, BETWEEN TASKS. GENERALLY SPEAKING, SUBJECTS GAVE INTERPRETATIONS CONSISTENT WITH QUANTIFIED NATURAL LANGUAGE QUESTIONS OR VENN DIAGRAMS, BUT NOT EQUIVALENY TO THEM. SUBJECTS USED EXPLICIT SET SPECIFICATIONS RARELY IN SPONTANEOUS ENGLISH.

TENTATIVE SUGGESTIONS ARE MADE FOR THE DESIGN OF FORMAL AND NATURAL-ANGUAGE QUESTION-ANSWER INTERFACES. (A)

32P, 31R. COMMENTS:

THIS REPORT DESCRIBES EXPERIMENTS THAT HAVE BEEN REPORTED PREVIOUSLY, AS WELL AS A SERIES OF PILOT EXPERIMENTS. THESE EXPERIMENTS APPEAR TO HAVE BEEN CAREFULLY CONTROLLED AND CONDUCTED AND, TAKEN TOGETHER, THEY CONSTITUTE A FAIRLY COMPREHENSIVE RESEARCH PROGRAM ON THE USE OF QUANTIFIERS AND QUESTION ASKING. THE PRESENTED RECOMMENDATIONS ARE CLASSIFIED AS TENTATIVE PRIMARILY DUE TO THE LACK OF LARGE SCALE RESEARCH IN THIS AREA. THESE RECOMMENDATIONS, HOWEVER, ARE CONSISTENT WITH THE RESULTS REPORTED HERE, WOULD BE FAIRLY EASY TO IMPLEMENT, AND SHOULD IMPROVE THE QUALITY OF QUESTION—AND—ANSWER DIALOGUES.

509 QUERY LANGUAGES

THOMAS, J.C., & GOULD, J.D. A PSYCHOLOGICAL STUDY OF QUERY BY EXAMPLE. AFIPS CONFERENCE PROCEEDINGS, 1975, 44, 439-445 (ALSO IBM REPORT RC-5124, IBM WATSON RESEARCH CENTER, YORKTOWN HEIGHTS, NEW YORK, NOVEMBER 1974).

DESCRIPTION:

THIRTY-NINE NON-PROGRAMMERS WERE TAUGHT ZLOOF'S QUERY BY EXAMPLE SYSTEM IN ORDER TO PROVIDE BEHAVIORAL DATA PRIOR TO IMPLEMENTATION. THIS TRAINING TOOK LESS THAN THREE HOURS. THEN SUBJECTS WERE GIVEN 40 TEST QUESTIONS IN ENGLISH WHICH THEY TRANSLATED INTO QUERY BY EXAMPLE. SUBJECTS ALSO RECORDED THE TIME TO WRITE EACH QUERY AND THEIR CONFIDENCE ABOUT BEING CORRECT. SIXTY-SEVEN PER CENT OF THE QUERIES WERE WRITTEN CORRECTLY. SUBJECTS AVERAGED 1.8 MINUTES TO WRITE QUERIES. QUERY DIFFICULTY COULD LARGELY BE PREDICTED FROM A LINEAR REGRESSION BASED ON OBJECTIVE COMPLEXITY MEASURES. CONFIDENCE RATING WAS ALSO AN EXCELLENT PREDICTOR OF QUERY DIFFICULTY. SUBJECTS HAD DIFFICULTY WITH QUANTIFICATION BUT LITTLE TROUBLE WITH LINKING VARIABLES, CONJUNCTIONS OR DISJUNCTIONS. IN A TWO-WEEK RETEST, FOUR OF SIX SUBJECTS SHOWED NEARLY PERFECT RETENTION OF THE SYSTEM RULES. RECOMMENDATIONS TO HELP PREVENT CERTAIN ERROR TYPES ARE MADE. (A) 7P, 17R.

COMMENTS:

THIS PAPER COULD SERVE AS A MODEL FOR BEHAVIORAL EVALUATIONS OF NEW IDEAS IN MAN-COMPUTER LANGUAGES AND DIALOGUE TECHNIQUES. THE STUDY WAS VERY WELL DONE AND REPORTED. IT PROVIDES FAIRLY CONVINCING EVIDENCE THAT NON-PROGRAMMERS ARE EASILY ABLE TO LEARN, USE, AND REMEMBER THE QUERY-BY-EXAMPLE METHOD, AND THAT PERFORMANCE BY THESE SUBJECTS WAS A GOOD DEAL BETTER THAN PERFORMANCE IN A PREVIDUS STUDY OF AN IGF-LIKE LANGUAGE. WHILE THIS PESULT IS PROBABLY GENERALIZABLE TO MOST CASUAL USERS OF QUERY SYSTEMS, IT SHOULD NOT BE UNCRITICALLY APPLIED EITHER TO HIGHLY EXPERIENCED USERS OR TO PROGRAMMERUSERS. THE AUTHORS ALSO POINT OUT THAT PERFORMANCE IN THEIR TASK, INVOLVING TRANSLATION OF QUERIES INTO A SPECIFIED LANGUAGE, IS DISSIMILAR TO THE TASK OF GENERATING QUERIES.

510 GRAPHICAL MENU-SELECTION DIALOGUE FOR HIERARCHIC SEARCH
THOMPSON, D.A. MAN-COMPUTER SYSTEM: TOWARD BALANCED CO-OPERATION IN
INTELLECTUAL ACTIVITIES. IN PROCEEDINGS, INTERNATIONAL SYMPOSIUM ON MANMACHINE SYSTEMS (IEEE CONFERENCE RECORD NO. 69C58-MMS) (VOL. 1). NEW YORK:
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, SEPTEMBER 1969.
DESCRIPTION:

GRAPHIC DISPLAYS ALLOW THE ON-LINE DISPLAY OF DECISION-TREE SEARCH HIERARCHIES, SO THAT A NAIVE USER OF AN INTERACTIVE SYSTEM, PARTICULARLY AN INFORMATION RETRIEVAL SYSTEM, CAN BE MADE CONTINUALLY AWARE OF THE OPTIONS AVAILABLE TO HIM. THIS HIGHLY DESIRABLE TECHNIQUE ALLOWS THE USER TO SEARCH THE HIERARCHY BY RECOGNITION, RATHER THAN RECALL, SO THAT MUCH LESS PRIOR KNOWLEDGE OF THE APPLICABLE CLASSIFICATION STRUCTURE IS REQUIRED. EXAMPLES OF DECISION-TREE SEARCH TECHNIQUES ARE GIVEN. STUDIES ARE UNDERWAY TO DETERMINE OPTIMUM CHARACTERISTICS OF SUCH DISPLAYS, PARTICULARLY WITH RESPECT TO NUMBER OF ALTERNATIVES AT A DECISION NODE, NUMBER OF PREVIOUS LEVELS DISPLAYED, AND DISPLAY OR NON-DISPLAY OF ALTERNATIVE BRANCHES TO THOSE ALREADY SELECTED.

## COMMENTS:

THE BASIC CONCEPTS IN THIS PAPER ARE MORE FULLY DEVELOPED IN A LATER PAPER BY THE SAME AUTHOR (THOMPSON, D.A., 1971). HOWEVER, THIS PAPER USES A DIFFERENT EXAMPLE (SEARCH OF A JOB-DESCRIPTION DATA BASE) TO DISCUSS THE DIALOGUE TECHNIQUE, AND CONTAINS A LITTLE MORE DISCUSSION OF THE RELATIONSHIP OF USER EXPERIENCE TO DIALOGUE TECHNIQUE. FOR MOST PURPOSES, THE READER WOULD BE WELL ADVISED TO CONSULT THE LATER PAPER.

511 GRAPHICAL MENU-SELECTION DIALOGUE FOR HIERARCHIC SEARCH
THOMPSON, D.A. INTERFACE DESIGN FOR AN INTERACTIVE INFORMATION RETRIEVAL
SYSTEM: A LITERATURE SURVEY AND A RESEARCH SYSTEM DESCRIPTION. JOURNAL OF THE
AMERICAN SOCIETY FOR INFORMATION SCIENCE, 1971, 22, 361-373.
DESCRIPTION:

THIS ARTICLE FOCUSES ON THE HUMAN INTERACTION CHARACTERISTICS OF AN INFORMATION RETRIEVAL SYSTEM, SUGGESTS SOME DESIGN CONSIDERATIONS TO IMPROVE MAN-MACHINE COOPERATION, AND DESCRIBES A RESEARCH SYSTEM AT STANFORD THAT IS EXPLORING SOME OF THESE TECHNIQUES.

LIBRARIANS CAN ONLY BE OF LIMITED ASSISTANCE IN HELPING THE NAIVE USER FORMULATE AN UNSTRUCTURED FEELING IN HIS MIND INTO AN APPROPRIATE SEARCH QUERY THAT MAPS INTO THE RETRIEVAL SYSTEM. CONSEQUENTLY, THE PROCESS OF QUERY FORMULATION BY THE USER, INTERACTIVELY WITH THE INFORMATION AVAILABLE IN THE SYSTEM, REMAINS ONE OF THE PRINCIPAL PROBLEMS IN INFORMATION RETRIEVAL TODAY.

IN AN ATTEMPT TO SOLVE THIS PROBLEM BY IMPROVING THE IMTERFACE COMMUNICATION BETWEEN MAN AND THE COMPUTER, WE HAVE PURSUED THE OBJECTIVE OF DISPLAYING HIERARCHICALLY STRUCTURED INDEX TREES ON A CRT IN A DECISION TREE FORMAT PERMITTING THE USER MERELY TO POINT (WITH A LIGHT PEN) AT ALTERNATIVES WHICH SEEM MOST APPROPRIATE TO HIM. USING HIS PASSIVE RATHER THAN HIS ACTIVE VOCABULARY EXPANDS HIS INTERACTION VOCABULARY BY AT LEAST AN ORDER OF MAGNITUDE. MOREOVER, A MIERARCHICALLY DISPLAYED INDEX IS A MODIFIED THESAURUS, AND MAY BE AUGMENTED BY ADDING LATERAL LINKS TO PROVIDE SEMANTIC ASSISTANCE TO THE USER. A HIERARCHICAL STRUCTURE WAS CHOSEN BECAUSE IT SEEMS TO REPLICATE THE STRUCTURE OF COGNITIVE THOUGHT PROCESSES MOST CLOSELY, THUS ALLOWING THE SIMPLEST, MOST DIRECT TRANSFER OF THE MAN'S PROBLEM INTO THE STRUCTURE AND VOCABULARY OF THE SYSTEM. (A) 13P, 55R.

# COMMENTS:

THIS PAPER PROVIDES CONSIDERABLE INSIGHT INTO THE MAN-COMPUTER DIALOGUE ASPECTS OF INFORMATION RETRIEVAL SYSTEMS, ESPECIALLY BIBLIOGRAPHIC SEARCH SYSTEMS. THE AUTHOR PRESENTS CONSIDERABLE EVIDENCE TO SUPPORT HIS CONTENTION THAT SUCH SYSTEMS SHOULD, WHERE POSSIBLE, PROVIDE HIERARCHIC INDEXES ACCESSIBLE VIA COMPUTER-INITIATED DIALOGUE (E.G., A LIGHTPEN, MENU-SELECTION DIALOGUE), IN ORDER TO TAKE ADVANTAGE OF THE USER'S PASSIVE VOCABULARY, PROVIDE A GOAL-DIRECTED SEARCH, AND PROVIDE EASY, NATURAL DIALOGUE. HE THEN DESCRIBES A SYSTEM AT STANFORD UNIVERSITY WHICH HAS THESE FEATURES, AND COMPARES IT (ANALYTICALLY, NOT EXPERIMENTALLY) WITH OTHER SYSTEMS. THIS IS A GOOD PAPER FOR THOSE INTERESTED IN INFORMATION RETRIEVAL SYSTEMS AND DIALOGUE TECHNIQUES.

512 NATURAL ENGLISH PROCESSING
THOMPSON, F.B. ENGLISH FOR THE COMPUTER. AFIPS CONFERENCE PROCEEDINGS, 1966,
29, 349-356.
DESCRIPTION:

THIS PAPER IS CONCERNED WITH USING NATURAL LANGUAGE AS A PROGRAMMING LANGUAGE. TWO ISSUES MUST BE CONSIDERED IN DEVELOPING A SYNTAX-DIRECTED INTERPRETER FOR ENGLISH. THE FIRST ISSUE CONCERNS MEMORY MANAGEMENT AND STRUCTURING. ONCE THE STRUCTURE HAS BEEN DEFINED, THE SECOND ISSUE IS CONCERNED WITH DEVELOPING A SYNTAX THAT CORRESPONDS TO THESE STRUCTURAL CATEGORIES. THE USE OF NATURAL ENGLISH WOULD ALLOW THE USER TO CONCENTRATE MORE ON THE PROBLEM AND LESS ON ITS TRANSLATION.

8P, 17R. COMMENTS:

THIS PAPER BEGINS WITH THE FALSE PREMISE THAT NATURAL ENGLISH IS THE IDEAL LANGUAGE FOR PROGRAMMING AND OTHERWISE INTERACTING WITH COMPUTERS AND PROCEEDS TO ADDRESS, IN A THEORETICAL WAY, THE PROBLEMS OF IMPLEMENTING SUCH A DIALOGUE METHOD. MANY OF THE PAPER'S ASSERTIONS CONCERNING PSYCHOLINGUISTICS ARE, AT LEAST IN RETROSPECT, DEBATABLE. THE PAPER IS SOMEWHAT REPRESENTATIVE OF THE EARLY OPTIMISM OF MANY THAT NATURAL-LANGUAGE PROCESSING WAS UNIVERSALLY APPLICABLE AND JUST AROUND THE CORNER. THERE ARE, HOWEVER, MANY MAN-COMPUTER DIALOGUE APPLICATIONS FOR WHICH NATURAL LANGUAGE IS NOT OPTIMAL OR IS EVEN ENTIRELY UNSUITABLE (E.G., COMPUTER-AIDED DESIGN). AND, UNFORTUNATELY, EVEN IN THOSE AREAS IN WHICH IT IS SUITABLE, IT HAS PROVEN MORE DIFFICULT THAN THIS PAPER ANTICIPATES. IF READ CRITICALLY, HOWEVER, THIS PAPER WILL CERTAINLY PROVIDE INFORMATION ABOUT SOME OF THE PSYCHOLINGUISTIC ISSUES IN THE IMPLEMENTATION OF NATURAL-LANGUAGE DIALOGUE.

513 USE OF GAMING TECHNIQUES FOR SYSTEM EVALUATION
TIEDE, R.V., & LEAKE, L.A. A METHOD FOR EVALUATING THE COMBAT EFFECTIVENESS OF
A TACTICAL INFORMATION SYSTEM IN A FIELD ARMY. OPERATIONS RESEARCH, 1971, 19,
587-604.

DESCRIPTION:

THIS PAPER DESCRIBES A METHOD THAT WAS DEVELOPED FOR MODELING INTERACTIONS IN GROUND COMBAT BETWEEN INFORMATION FLOWS AND TACTICAL DECISION MAKING. THE PURPOSE WAS TO PROVIDE MEANS FOR MEASURING THE EFFECTIVENESS OF TACTICAL INFORMATION SYSTEMS IN A FIELD ARMY. GAMING WAS CHOSEN FOR THE BASIC METHOD BECAUSE THE ESSENCE OF THE PROBLEM WAS THE GROUND COMMANDER'S ABILITY TO MAKE EFFECTIVE USE OF BETTER INFORMATION AS PROVIDED BY AN IMPROVED TACTICAL INFORMATION SYSTEM. NEAR-REAL-TIME PLAY OF DIVISION-LEVEL COMBAT WAS MADE POSSIBLE BY PROVIDING ON-LINE COMPUTER ASSISTANCE TO THE CONTROL GROUP. COMBAT OUTCOMES ARE RELATED TO MISSION REQUIREMENTS TO OBTAIN MEASURES OF EFFECTIVENESS. (A)

COMMENTS:

THIS IS A GOOD EXAMPLE OF THE USE OF GAMING TECHNIQUES TO EVALUATE THE POTENTIAL EFFECTIVENESS OF A PROPOSED AUTOMATED INFORMATION SYSTEM. ALTHOUGH THIS PARTICULAR EXAMPLE PRIMARILY ADDRESSES THE ARMY'S TACTICAL INFORMATION SYSTEM (TOS), IT ILLUSTRATES SOME OF THE ADVANTAGES AND DISADVANTAGES OF THIS APPROACH TO SYSTEM FVALUATION RATHER WELL. THE USE OF GAMING USUALLY REQUIRES FAIRLY EXTENSIVE MODEL AND GAME DEVELOPMENT AND REQUIRES THE DEVELOPMENT OF MEASURES OF EFFECTIVENESS WHICH ARE RELATED TO GAME OBJECTIVES. THUS, IT MAY INVOLVE A SIGNIFICANT INVESTMENT TO DEVELOP AN AUTOMATED GAME WHOSE UTILITY IS LARGELY CONFINED TO A PARTICULAR MODEL AND GAME SCENARIO. FURTHERMORE, THE VALIDITY OF THE EVALUATION CAN ONLY BE AS GREAT AS THE VALIDITY OF BOTH THE SYSTEM MODEL AND THE GAME. FOR EXAMPLE, TOS IS MODELED HERE ENTIRELY IN TERMS OF DELAYS AND QUALITY DEGRADATION OF TACTICAL MESSAGES. IF THE ASSUMED MODEL FAILS TO CORRECTLY REPRESENT THE CAPABILITIES OF A TOS, THE GAME CAN PROVIDE MISLEADING INFORMATION. ON THE OTHER HAND, GAMING HAS SOME VERY STRONG ADVANTAGES, ALLOWING EMPIRICAL EVALUATION OF SYSTEMS WHILE THEY ARE STILL IN THE DESIGN STAGE, AND ALLOWING EVALUATION OF SYSTEMS WHILE THEY ARE STILL IN THE DESIGN STAGE, AND ALLOWING EVALUATION OF SYSTEMS INTENDED FOR USE ONLY IN SPECIALIZED SITUATIONS. ALL OF THESE CONSIDERATIONS ARE ILLUSTRATED IN THIS PAPER, WHICH IS BOTH INFORMATIVE AND VERY READABLE. WHILE THE PAPER ILLUSTRATES THE METHOD WELL, ITS GAMING EXAMPLE IS SOMEWHAT LIMITED BY SMALL SAMPLE SIZE AND CONSIDERATION OF ONLY THE MESSAGE DELAY AND ERROR ASPECTS OF A TACTICAL INFORMATION SYSTEM.

514 MODEL OF MAN-COMPUTER DIALOGUE
TING, T.C., & BADRE, A.N. A DYNAMIC MODEL OF MAN-MACHINE INTERACTIONS: DESIGN
AND APPLICATION WITH AN AUDIOGRAPHIC LEARNING FACILITY. INTERNATIONAL
JOURNAL OF MAN-MACHINE STUDIES, 1976, 8, 75-88.
DESCRIPTION:

A GENERALIZED CONCEPTUAL DYNAMIC MODEL OF MAN-MACHINE INTERACTIONS WITH ITS SYMBOLIC DESCRIPTION IS PROPOSED. THE MODEL IS INTENDED TO REPRESENT THE MAN-MACHINE INTERACTIVE BEHAVIORS OF INTERACTIVE ADAPTIVE LOGIC SYSTEMS. A STUDY OF AN ONLINE AUDIOGRAPHIC LEARNING FACILITY, WITH EMPHASIS ON A PRE-SELECTED SET OF INTERACTIVE FUNCTIONS, IS PRESENTED TO ILLUSTRATE THE USE OF THE MODEL. (A) 14P, 9R.

COMMENTS:

THE PROPOSED MODEL EXPRESSES THE "DEGREE OF (MAN-COMPUTER) INTERACTION" AS THE PRODUCT OF TWO SCALAR QUANTITIES, ONE OF WHICH IS A SUMMARY MEASURE OF THE USER'S "EXPERIENCE, INTELLIGENCE, ABILITIES, ETC.", WHILE THE OTHER IS A MEASURE OF THE "VALUE OF THE I/O OPERATIONS." THE LATTER FACTOR IS THEN EXPRESSED AS A LINEAR FUNCTION OF THE INDIVIDUAL VALUES OF THE CANDIDATE 1/0 OPERATIONS OF THE SYSTEM. THIS MAY BE A USEFUL CONCEPTUAL MODEL, BUT IT SEEMS UNLIKELY THAT A SINGLE SCALAR QUANTITY WILL PROVE SUFFICIENT TO EXPRESS THOSE PROPERTIES OF USERS WHICH AFFECT THE DESIGN OF A DIALOGUE. PERHAPS FUTURE WORK ON THE MODEL WILL EXPAND THIS ASPECT. THE EXPERIMENTAL STUDY, WHICH IS REPORTED AS A PRELIMINARY TEST OF THE MODEL, HAS SOME VALUE IN ITS OWN RIGHT AND MAY BE METHODOLOGICALLY SUGGESTIVE FOR SOME DESIGNERS, BUT DOES NOT APPEAR TO TEST THE MODEL. BASICALLY, SUBJECTS' RATINGS OF SYSTEM USEFULNESS WERE CORRELATED WITH PRESENCE OR ABSENCE OF TWO SPECIFIC INTERFACE PROPERTIES IN A PARTICULAR COMPUTER-ASSISTED INSTRUCTION SYSTEM. INTERFACE PROPERTIES IN A PARTICULAR COMPUTER-ASSISTED INSTRUCTION SYSTEM.
THE RESULTING MULTIPLE REGRESSION EQUATION MAY HAVE IMPLICATIONS FOR DESIGN
TRADEDFFS. IT SHOULD BE NOTED, HOWEVER, THAT THESE SUBJECTIVE RATINGS ARE
NOT A PERFORMANCE MEASURE AND DO NOT REFLECT "DEGREE OF (MAN-COMPUTER)
INTERACTION." THIS IS ONLY A TEST, THEN, OF THE METHOD OF EVALUATING THE
"VALUE OF THE I/O OPERATION" FACTOR. BUT IT SEEMS LIKELY THAT A LINEAR
REGRESSION MODEL WOULD EXPLAIN THESE SUBJECTIVE RATINGS EVEN IF A LINEAR MODEL SHOULD PROVE INAPPROPRIATE FOR PREDICTING MAN-COMPUTER COMMUNICATION LINEAR REGRESSION TECHNIQUES HAVE BEEN USED VERY SUCCESSFULLY PERFORMANCE. TO CAPTURE SUBJECTIVE PREFERENCES AND DECISION POLICIES (SEE SLOVIC, P., LICHTENSTEIN, S., COMPARISON OF BAYESIAN AND REGRESSION APPROACHES TO THE STUDY OF INFORMATION PROCESSING IN JUDGMENT, JOURNAL OF ORGANIZATIONAL BEHAVIOR AND HUMAN PERFORMANCE, 1971, 6, 649-744). PERFORMANCE MODELS SHOULD BE VALIDATED WITH PERFORMANCE STUDIES. THE PAPER SHOULD BE OF INTEREST TO THOSE CONCERNED WITH MODELS OF MAN-COMPUTER COMMUNICATION, AND ITS LINEAR REGRESSION APPROACH TO DESIGN TRADEOFFS MAY BE HELPFUL TO SYSTEM DESIGNERS.

515 GENERAL DISCUSSION OF HUMAN FACTORS IN COMPUTER SYSTEMS
TOMESKI, E.A., & LAZARUS, H. PEOPLE-ORIENTED COMPUTER SYSTEMS. NEW YORK: VAN
NOSTRAND REINHOLD CO., 1975.
DESCRIPTION:

THIS BOOK SHOULD APPEAL TO EXECUTIVES, IN BUSINESS AND GOVERNMENT AND INDUSTRIAL ORGANIZATIONS, WHO HAVE EXPERIENCED (AND WHO HASN'T) THE FRUSTRATIONS OF RARELY SEEING FULFILLED THE GREAT PROMISES OF COMPUTERIZATION. TODAY, MANY ORGANIZATIONS FIND IT DIFFICULT TO LIVE WITH COMPUTERS—BUT APPARENTLY NO ORGANIZATION OF ANY SIZE CAN LIVE WITHOUT THEM. FOR GOOD OR ILL, THEY CANNOT BE ELIMINATED. THE AUTHORS PROVIDE INSIGHTS ABOUT THE REASONS FOR THE UNFULFILLED PROMISES OF COMPUTERS—PARTICULARLY THE DISREGARD OF THE "PEOPLE PROBLEMS" IN COMPUTER SYSTEMS AND THE LOW PRIORITY GIVEN TO COMPUTERIZING THE PERSONNEL FUNCTION—AND SET FORTH WHAT THEY FIND IS NEEDED TO OBTAIN REALLY EFFECTIVE RESULTS FROM THE MISDIRECTED TOOL.

THIS BOOK'S CENTRAL PREMISE IS THAT THE COMPUTER'S CONTRIBUTION TO SOCIETY HAS BEEN CONSIDERABLY HINDERED AN OVERLY MECHANISTIC APPROACH USED BY BOTH MANUFACTURERS AND USERS OF COMPUTER SYSTEMS. MANY ORGANIZATIONS DEVELOP COMPUTER PRODUCTS AND APPLICATIONS WITH GREAT ATTENTION TO TECHNICAL AND ECONOMIC FACTORS -- BUT WITH MINIMAL ATTENTION TO THE MOST IMPORTANT RESOURCE: PEOPLE. (A, ABBR.) 320P, 155R.

COMMENTS:

ALTHOUGH THE AUTHORS DISCUSS AT GREAT LENGTH THE "HUMAN FACTORS IN COMPUTER SYSTEMS," THEY EMPLOY A VERY MARROW DEFINITION OF THIS CONCEPT. THEIR PRIMARY EMPHASIS IS ON SOCIAL IMPLICATIONS OF COMPUTERS SUCH AS UNEMPLOYMENT, INTERPERSONAL COMMUNICATION, PRIVACY, ETC. THE AUTHORS REPEATEDLY ARGUE THAT COMPUTERS MUST BE "PLANNED PRIMARILY TO BENEFIT PEOPLE AND SOCIETY" AND "INSTALLED TO SERVE THE SOCIAL SYSTEM." WHILE THESE GOALS MAY BE DESIRABLE, THE MORE APPROPRIATE APPROACH APPEARS TO BE CONTROLLED STUDY AT THE MAN-COMPUTER SYSTEM, RATHER THAN A LARGELY PHILOSOPHICAL DISCUSSIONS OF COMPUTER SYSTEMS. THE EMPHASIS ON COMPUTER SYSTEMS, RATHER THAN MAN-COMPUTER SYSTEMS APPEARS MISPLACED.

516 LARGE-SCREEN DISPLAYS

TON, W.H. OPTIMAL VISUAL CHARACTERISTICS FOR LARGE SCREEN DISPLAYS. INFORMATION DISPLAY, JULY/AUGUST 1969, 6(4), 48-52. DESCRIPTION:

THE AUTHOR HAS REVIEWED STUDIES IN THE PSYCHOLOGY AND PHYSIOLOGY OF VISION WHICH ARE PERTINENT TO THE DESIGN OF LARGE SCREEN DISPLAYS. THE STUDIES WERE FOCUSED ON THE AREAS OF SYMBOL SIZE AND SPACING, COLOR USAGE, CODING, REGISTRATION, REFRESH RATE AND AMBIENT ILLUMINATIONS. FINALLY, THE AUTHOR SUMMARIZED THE FINDINGS OF THE STUDIES AS A SERIES OF GUIDELINE STATEMENTS.

COMMENTS:

THIS PAPER PRESENTS SIXTEEN GUIDELINES FOR DESIGNING LARGE SCREEN DISPLAYS. THESE GUIDELINES FALL INTO THREE CATEGORIES. SOME GUIDELINES HAVE BEEN EMPIRICALLY VALIDATED ELSEWHERE AND SHOULD BE USEFUL AND FAIRLY GENERAL. OTHER PRESENTED GUIDELINES, HOWEVER, ARE LESS USEFUL (E.G., AVOID FLICKER) AND SOME APPEAR TO REPRESENT THE AUTHOR'S OPINION AND HAVE NOT YET BEEN TESTED. THE READER SHOULD EXERCISE CARE, THEREFORE, IN SELECTING GUIDELINES FOR APPLICATION.

517 MODELING AND SIMULATION OF USER PERFORMANCE
TOPMILLER, D.A. MATHEMATICAL MODELS OF HUMAN PERFORMANCE IN MAN-MACHINE
SYSTEMS (TECHNICAL REPORT AMRL-TR-68-22). WRIGHT-PATTERSON AFB, OHIO:
AEROSPACE MEDICAL RESEARCH LABORATORIES, MAY 1968. (NTIS NO. AD 673348)
DESCRIPTION:

THIS REPORT DESCRIBES THREE APPROACHES TO THE PROBLEM OF MATHEMATICALLY REPRESENTING HUMAN PERFORMANCE PARAMETERS IN WEAPON, MAINTENANCE, AND COMMAND AND CONTROL SYSTEMS. IN THE FIRST APPROACH, TWENTY OPERATIONS RESEARCH ANALYSES AND MODELS OF MILITARY SYSTEMS WERE EXAMINED TO DETERMINE IF THE MODELS INCLUDED HUMAN FACTORS PARAMETERS AND TO WHAT EXTENT THEY WERE SENSITIVE TO VARIATIONS IN THESE PARAMETERS. ALTHOUGH MANY OF THE FUNCTIONS OF THE SYSTEMS MODELED WERE PERFORMED BY HUMANS, MANY PERFORMANCE PARAMETERS WERE NOT, IN GENERAL, SUFFICIENTLY DEFINED TO PERMIT MATHEMATICAL OR EMPIRICAL MANIPULATIOM WITHIN A MAN-MACHINE SIMULATION FRAMEWORK. IN THE SECOND APPROACH, AN ATTEMPT WAS MADE TO ESTABLISH PREDICTIVE RELATIONSHIPS, BASED ON REGRESSION AND FACTOR ANALYSIS TECHNIQUES, BETWEEN HUMAN ENGINEERING DESIGN PARAMETERS AND THOSE CRITERIA OF SYSTEMS EFFECTIVENESS, SUCH AS MAINTENANCE TASK TIME, THAT CAN BE TRANSFORMED INTO A MORE MOLAR INDEX: SYSTEM DOWNTIME. THE HUMAN ENGINEERING PREDICTOR-PARAMETERS ACCOUNTED FOR SOX OF THE CRITERION YARIANCE. IN THE THIRD APPROACH, A SERIES OF EXPERIMENTS INVOLVING REAL-TIME SIMULATION OF A COMMAND AND CONTROL SYSTEM WAS CONDUCTED TO DETERMINE IF, AND HOW, A COMPUTER MIGHT AID DIAGNOSTIC PERFORMANCE (IN TACTICAL DECISION MAKING) IN THREAT EVALUATIONS. THE SYSTEM OUTPUT OR CRITERION OF EFFECTIVENESS WAS THE DEGREE TO WHICH THE SYSTEM ASSESSES THE TRUE STATE OF THREAT. WITH COMPUTER AIDING, CORRECT DECISIONS INCREASED BY 13%. (A)

COMMENTS:

THIS PAPER CONSIDERS OPERATIONS RESEARCH MODELS, FACTOR ANALYTIC STUDIES, AND DECISION MODELING IN THE CONTEXT OF SYSTEM SIMULATIONS AS METHODS OF MODELING THE EFFECTS OF HUMAN PERFORMANCE VARIABLES ON SYSTEM PERFORMANCE. OPERATIONS RESEARCH MODELS WERE FOUND INAPPROPRIATE, AT LEAST AS CURRENTLY PRACTICED. A FACTOR-ANALYTIC STUDY HAD PROMISING RESULTS IN THE CONTEXT OF A NON-COMPUTER-RELATED MAINTENANCE TASK. PRESUMABLY, SIMILAR METHODS WOULD APPLY TO INTERACTIVE TASKS. THE THIRD STUDY INVOLVED THE SIMULATED USE OF A COMPUTERIZED DECISION AID, AND MET WITH SOME SUCCESS. THE TASK INVOLVED INTEGRATION OF RECONNAISSANCE INFORMATION DEGRADED TO VARIOUS DEGREES. COMPUTER-AIDED DECISIONS BECAME BETTER THAN NONAIDED DECISIONS AS FIDELITY OF DATA DECLINED AND AS QUANTITY OF DATA INCREASED (SEE HOWELL, W.C., & GETTYS, C.F., 1968 FOR MORE DETAIL). THIS PAPER INTEGRATES AND COMPARES THESE MODELING APPROACHES ONLY VERY LOOSELY, BUT MAY HELP THOSE INTERESTED IN DEVELOPING SUCH MODELS.

518 COMMAND AND CONTROL SYSTEMS

TOPMILLER, D.A. MAN-MACHINE COMMAND-CONTROL-COMMUNICATION SIMULATION STUDIES IN THE AIR FORCE (TECHNICAL REPORT NO. AMRL-TR-76-122). WRIGHT-PATTERSON AIR FORCE BASE, OHIO: AEROSPACE MEDICAL RESEARCH LABORATORY, AEROSPACE MEDICAL DIVISION, SEPTEMBER 1976. (NTIS NO. AD A042148) DESCRIPTION:

THIS PAPER REVIEWS AND SUMMARIZES APPROXIMATELY FIFTEEN YEARS OF MANMACHINE SIMULATION RESEARCH IN COMMAND, CONTROL, AND COMMUNICATION SYSTEMS CONDUCTED BY THE AEROSPACE MEDICAL RESEARCH LABORATORY. SUMMARIES OF DECISION AIDING TECHNIQUES FOR TACTICAL COMMAND DECISION MAKING CONDUCTED AT OHIO STATE UNIVERSITY ARE MADE. DESCRIPTIONS AND SUMMARY FINDINGS OF C-3 SIMULATIONS FOR THE BACK-UP INTERCEPTOR CONTROL SYSTEM (BUIC III), THE ADVANCED AIRBORNE WARNING AND CONTROL SYSTEM (AWACS) AND REMOTELY PILOTED VEHICLE SYSTEMS (RPV'S) ARE PRESENTED. A COMPARISON OF RESULTS OBTAINED WITH REAL-TIME OPERATOR-IN-THE-LOOP SIMULATIONS WITH COMPUTER SIMULATIONS USING A SYSTEMS INTEGRATED NETWORK OF TASKS (SAINT) MODEL PREDICTIONS WERE ILLUSTRATED TO DEMONSTRATE THE POWER AND UTILITY OF ITERATING COMPUTER SIMULATION WITH REAL-TIME SIMULATIONS. (A)

COMMENTS:

THIS IS A BRIEF, EASY TO READ SUMMARY OF FOUR PROJECTS CONCERNED WITH MANCOMPUTER SYSTEMS IN COMMAND, CONTROL, AND COMMUNICATION. THE FIRST PROJECT,
CONCERNED WITH COMMAND DECISION FUNCTIONS, IS DESCRIBED IN SOME DETAIL IN
W.C. HOWELL (1967). THE LATTER PROJECTS DEAL PRIMARILY WITH SURVEILLANCE
TASKS. THE AUTHOR NOTES THAT C-3 SYSTEMS HAVE EVOLVED BASED ON THE
ASSUMPTION THAT BIGGER AND FASTER COMPUTERS ARE BETTER, WITH LITTLE OR NO
REGARD FOR WHETHER SUCH "IMPROVEMENTS" INCREASE THE EFFECTIVENESS OF THE
MAN-COMPUTER SYSTEM. THE EXPERIMENTS DESCRIBED IN THIS PAPER INDICATE
THAT THIS ASSUMPTION IS OFTEN INVALID.

TREU, S. A CONCEPTUAL FRAMEWORK FOR THE SEARCH SYSTEMS
TREU, S. A CONCEPTUAL FRAMEWORK FOR THE SEARCHER-SYSTEM INTERFACE. IN D.E. WALKER (ED.), INTERACTIVE BIBLIOGRAPHIC SEARCH: THE USER/COMPUTER INTERFACE. MONTVALE, NEW JERSEY: AFIPS PRESS, 1971, 53-66.
DESCRIPTION:

A THOROUGH OVERVIEW, DIAGNOSIS, AND REDESIGN OF THE SEARCHER-SYSTEM INTERFACE, WITH PRIORITY EMPHASIS ON SATISFYING THE HUMAN SEARCHER'S CONCEPTUAL AND BEHAVIORAL CHARACTERISTICS, ARE URGENTLY NEEDED. TO ACCOMPLISH THIS, PRESENT AND PROSPECTIVE COMPUTER PROCESSING CAPABILITIES AND LIMITATIONS MUST, OF COURSE, BE TAKEN INTO ACCOUNT. HOWEVER, THE PRIMARY PURPOSE OF THIS PAPER IS TO SUGGEST AND TO SOME EXTENT CARRY OUT A VERY PRAGMATIC APPROACH TOWARD ARRIVING AT A SET OF PERTINENT HUMAN CHARACTERISTICS. THIS SET CAN THEN BE USED TO DEVELOP HYPOTHESES FOR EMPIRICAL INVESTIGATIONS. (A, ABBR.) 14P, BR.

COMMENTS:

THIS PAPER DESCRIBES A PRAGMATIC APPROACH TO INTERFACE DESIGN. THIS IS ESSENTIALLY AN ITERATIVE DESIGN PROCESS IN WHICH "GOOD" ASPECTS ARE RETAINED IN SUBSEQUENT REDESIGNS AND "BAD" ASPECTS CORRECTED. THE DISTINCTION BETWEEN "GOOD" AND "BAD", OF COURSE, ULTIMATELY MUST BE MADE BY THE USER. AN EXPERIMENTAL METHODOLOGY IS PROPOSED TO AID IN DETERMINING HOW SYSTEM CHARACTERISTICS AFFECT USERS. ALTHOUGH THIS METHODOLOGY, WHICH INVOLVES INTERPOSING AN ACTIVE OBSERVER BETWEEN THE USER AND THE SYSTEM, MAY BE OBTRUSIVE, IT MAY BE HELPFUL IN CONTROLLED, DETAILED INVESTIATIONS OF USER BEHAVIOR UNDER A VARIETY OF CONDITIONS. THE AUTHOR MAKES SEVERAL ASSUMPTIONS ABOUT DESIRABLE PROPERTIES OF INTERFACES IN BIBLIOGRAPHIC SEARCH SYSTEMS. ALTHOUGH NO ATTEMPT IS MADE TO VALIDATE THESE ASSUMPTIONS, THEY ARE IN GENERAL, TOO VAGUE (E.G., SIMPLICITY, VERSATILITY) TO SERVE AS USEFUL DESIGN GUIDELINES.

520 USER REQUIREMENTS DEFINITION AND SYSTEM EVALUATION TECHNIQUES
TREU, S. TECHNIQUES AND TOOLS FOR IMPROVING THE INTERACTIVE SYSTEM INTERFACE.
IN INTERACTIVE BIBLIOGRAPHIC SYSTEMS: PROCEEDINGS OF A FORUM HELD AT
GAITHERSBURG, MARYLAND, OCTOBER 1971. WASHINGTON, D.C.: U.S. ATOMIC ENERGY
COMMISSION OFFICE OF INFORMATION SERVICES, 1973, 32-38.
DESCRIPTION:

AFTER SOME ASSERTIONS ABOUT THE MEED FOR CONSIDERING THE USER AND HIS SYSTEM TO BE A TEAM AND FOR RECOGNIZING USER BEHAVIOR AND SATISFACTION IN ASSESSMENT OF TEAM PERFORMANCE, THE USE OF MORE UNOBTRUSIVE TECHNIQUES FOR PERTINENT DATA COLLECTION IS ADVOCATED. TWO TOOLS FOR ENABLING THESE TECHNIQUES ARE DESCRIBED: A DIALOGUE MONITOR, WHICH CAN RECORD THE ENTIRE TWO-WAY MESSAGE STREAM AND CERTAIN RELATED TIMING DATA, AND A USERSIMULATION SYSTEM, WHICH CAN ACTIVELY MANIPULATE THE INTERACTION WHILE COLLECTING DATA ON RESULTING USER SATISFACTION. (A)

COMMENTS:

THE AUTHOR IS, OF COURSE, CORRECT IN ASSERTING THAT IMPROVEMENTS IN EXISTING MAN-MACHINE INTERFACES ARE DESIRABLE. HE ASSERTS THAT THE USER AND INTERACTIVE SYSTEM BE CONSIDERED AS A TEAM, THAT USER BEHAVIOR AND SATISFACTION MUST BE TAKEN INTO ACCOUNT, AND THAT UNOBTRUSIVE TECHNIQUES ARE NEEDED FOR DATA COLLECTION. TWO TECHNIQUES ARE PROPOSED AS BOTH ADEQUATE AND UNOBTRUSIVE DATA COLLECTION TECHNIQUES. THE DIALOGUE MONITOR, HOWEVER, DOES NOT APPEAR TO BE ABLE TO CAPTURE ALL RELEVANT ASPECTS OF THE INTERACTION AND THE "USER-STIMULATION" SIMULATION, ALTHOUGH ADEQUATE, DOES NOT APPEAR TO BE UNOBTRUSIVE. ALTHOUGH IT MAY NOT BE POSSIBLE TO DEVELOP TRULY UNOBTRUSIVE AND ADEQUATE TECHNIQUES, CARE MUST BE TAKEN TO INSURE THAT THE MEASUREMENT TECHNIQUES EMPLOYED DO NOT INTERFERE WITH THE TASK THAT THE USER IS PERFORMING OR THE PROCESSES HE APPLIES TO THIS TASK. THIS SEEMS TO REQUIRE A BETTER UNDERSTANDING OF THE COGNITIVE PROCESSES INVOLVED IN A GIVEN TASK. THIS PAPER OUTLINES AN IMPORTANT AND DIFFICULT PROBLEM AREA AND THIS AREA DESERVES SERIOUS COMSIDERATION.

521 COMMAND LANGUAGE DESIGN BASED ON "MENTAL WORK" REQUIRED TREU, S. INTERACTIVE COMMAND LANGUAGE DESIGN BASED ON REQUIRED MENTAL WORK. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES, 1975, 7, 135-149. DESCRIPTION:

ALTHOUGH THE DEFINITION OF "MENTAL WORK" REMAINS ELUSIVE, SYSTEMATIC MEANS/METHODS SHOULD BE CONSIDERED FOR GAINING EVIDENCE ABOUT INTERACTIVE LANGUAGE FEATURES REQUIRING MORE/LESS EFFORT OF THE HUMAN MIND. THE SUGGESTED APPROACH EMPLOYS A STRUCTURING OF THE USER'S CONCEPTUAL REFERENCE SPACES INTO SETS OF "ACTION PRIMITIVES", PECULIAR TO THE TYPE OF COMPUTERAIDED TASK INVOLVED. AN INTERACTIVE COMMAND LANGUAGE CAN THEN BE REGARDED AS THE RANGE OF SOME TRANSFORMATION ON THE USER'S SET OF ACTION PRIMITIVES. THE NATURE AND EFFICIENCY OF THAT TRANSFORMATION, IN CONJUNCTION WITH THE INHERENT NUMBER OF MENTAL ASSOCIATION LINKS, ARE HYPOTHESIZED TO HAVE DIRECT RELATIONSHIPS TO THE LEVEL OF REQUIRED MENTAL WORK. THE USER'S DELAY OR "THINK TIME", EXPENDED IMMEDIATELY PRECEDING COMMAND UTILIZATION, IS ONE MEASURABLE QUANTITY THAT SHOULD BE USEFUL AS A WORK LEVEL INDICATOR. (A)

COMMENTS:

THIS PAPER IS INTENDED TO PROVIDE A FRAMEWORK THAT WOULD ALLOW COMMAND LANGUAGE DESIGNERS TO ESTIMATE THE AMOUNT OF "MENTAL WORK" REQUIRED OF THE USER. THE CONCEPT OF ACTION PRIMITIVES IS CENTRAL TO THIS FRAMEWORK AND FOURTEEN VARIABLES ARE DEFINED TO REPRESENT THE MENTAL WORK REQUIRED IN MAPPING ACTION PRIMITIVES INTO ACTUAL SYSTEM COMMANDS. IT IS NOT CLEAR, HOWEVER, HOW, OR EVEN IF, THESE VARIABLES ARE TO BE MEASURED. THE SUGGESTED MEASURES, USER TRANSACTION TIME AND USER COMMAND PREFERENCE, MAY CORRELATE WITH MENTAL WORK, BUT ARE NOT ADEQUATE FOR DEFINING ALL OF THE VARIABLES IN THIS FRAMEWORK. A WIDELY ACCEPTED AND WELL-UNDERSTOOD FRAMEWORK WOULD BE A SIGNIFICANT ADDITION TO THE AREA OF COMMAND LANGUAGE DESIGN, OR ANY OTHER ARE OF MAN-COMPUTER INTERACTION. A GREAT DEAL OF EMPIRICAL RESEARCH WOULD BE REQUIRED TO DETERMINE WHETHER THE FRAMEWORK PROPOSED HERE COULD BE USEFULLY APPLIED.

522 AUTOMATED SPEECH

TURN, R. SPEECH AS A MAN-COMPUTER COMMUNICATION CHANNEL (REPORT NO. P-5120). SANTA MONICA, CALIFORNIA: RAND CORP., JANUARY 1974. DESCRIPTION:

THIS PAPER INVESTIGATES THE INTRINSIC CHACTERISTICS AND ASSOCIATED ATTRACTIVE FEATURES AND PROBLEM AREAS OF THE USE OF SPEECH FOR MAN-TO-COMPUTER AS WELL AS FOR COMPUTER-TO-MAY COMMUNICATION. AMONG THE ATTRACTIVE FEATURES OF THE USE OF SPEECH FOR THESE PURPOSES IS ITS INDEPENDENCE OF THE VISUAL AND MANUAL COMMUNICATION CHANNELS, THE ABILITY TO COMMUNICATE SIMULTANEOUSLY WITH MAN AND MACHINE AND THE POTENTIAL OF USING A TELEPHONE INSTRUMENT AS A COMPLETE COMPUTER TERMINAL.

THE PROBLEM AREAS INCLUDE INTERFERENCE BY AMBIENT NOISE, THE VARIATION OF VOICE AND SPEECH CHARACTERISTICS WITH INDIVIDUAL SPEAKERS, THE PRESENT LACK OF COMPLETE KNOWLEDGE OF ACOUSTIC, LINGUISTIC AND SEMANTIC ASPECTS OF COMPUTER PROCESSING OF SPEECH, AS WELL AS THE PROCESSING REQUIREMENTS AND COST ASSOCIATED WITH THE LATTER. IT MAY BE EXPECTED, HOWEVER, THAT THE RESULTS OF THE CURRENT RESEARCH IN SPEECH RECOGNITION AND UNDERSTANDING WILL EVENTUALLY PERMIT ECONOMICALLY ATTRACTIVE IMPLEMENTATIONS OF SPEECH-BASED MAN-COMPUTER INTERFACES. (A) 17P, 19R.

COMMENTS:

THIS IS A GOOD, BRIEF REVIEW OF THE STATE OF THE ART IN AUTOMATED SPEECH PRODUCTION AND RECOGNITION. THERE ARE SOME MINOR PSYCHOLOGICAL INACCURACIES, BUT THEY DO NOT SERIOUSLY DETRACT FROM THE OVERALL QUALITY OF THE REVIEW. FOR EXAMPLE, THE AUTHOR ASSERTS THAT SEVERAL SPOKEN MESSAGES CAN BE RECEIVED AND COMPREHENDED SIMULTANEOUSLY, AND THAT SPEECH PERCEPTION CAN OCCUR INDEPENDENTLY OF COMMUNICATION ACTIVITIES WHICH MAY BE GOING ON VIA OTHER CHANNELS (E.G., VISION). THESE ASSERTIONS ARE CONTRARY TO OUR CURRENT UNDERSTANDING OF HUMAN INFORMATION PROCESSING CAPABILITY. MOST OF THE AUTHOR'S ARGUMENTS IN FAVOR OF NATURAL-LANGUAGE MAN-COMPUTER DIALOGUE ARE CORRECT, HOMEVER, AS FAR AS THEY GO. WHILE THE PAPER CONSIDERS A NUMBER OF TECHNICAL PROBLEMS, PARTICULARLY WITH AUTOMATED SPEECH RECOGNITION, IT GIVES LITTLE ATTENTION TO THE HUMAN FACTORS PROBLEMS WHICH MAY RESULT FROM THE USE OF SUCH TECHNIQUES TO IMPLEMENT CONSTRAINED DIALOGUES. IT SEEMS LIKELY THAT USERS CAN ADAPT SATISFACTORILY TO HIGHLY CONSTRAINED DIALOGUES IN SPOKEN LANGUAGE, AND TO UNCONSTRAINED NATURAL-LANGUAGE DIALOGUES WHEN OUR TECHNOLOGY ALLOWS THEM. THE AUTHOR SEEMS TO BE LOOKING FORWARD TO SOMETHING IN BETWEEN, HOWEVER. IT MAY PROVE TO BE VERY DIFFICULT FOR USERS TO HANDLE COMPLEX SPOKEN DIALOGUES WHEN THEIR SPOKEN INPUTS ARE HEAVILY (BUT INVISIBLY) CONSTRAINED BY SYNTACTIC AND SEMANTIC RESTRICTIONS UNLIKE THOSE OF NATURAL LANGUAGE. RESEARCH IS NEEDED IN THIS AREA, BUT IT IS DIFFICULT TO PERFORM SUCH RESEARCH SATISFACTORILY BECAUSE OF THE NEED TO SELECT A PARTICULAR SET OF SEMANTIC AND SYNTACTIC CONSTRAINTS WHICH MAY PROVE TO BE UNLIKE THOSE OF ACTUAL FUTURE SYSTEMS. FOR THOSE INTERESTED IN THE ARGUMENTS WHICH FAVOR SPOKEN DIALOGUE, AND IN THE TECHNICAL PROBLEMS AND ACCOMPLISHMENTS IN THE DEVELOPMENT OF THE NECESSARY HARDWARE, THIS IS A 6000 INTRODUCTION.

523 MENU-SELECTION DIALOGUES

UBER, G.T., WILLIAMS, P.E., HISEY, B.L., & SIEKERT, R.G. THE ORGANIZATION AND FORMATTING OF HIERARCHICAL DISPLAYS FOR THE ON-LINE INPUT OF DATA. AFIPS CONFERENCE PROCEEDINGS, 1968, 33, 219-226.

DESCRIPTION:

THE USE OF CRT DISPLAYS AND A LIGHT-PEN OR TOUCHWIRE DEVICE TO INPUT SELECTIONS FROM LISTS OF ALTERNATIVES ENABLES USERS, PARTICULARLY SUCH USERS AS MANAGERS AND PHYSICIANS, TO JORK THROUGH A HIERARCHY OF INFORMATION RAPIDLY AND ACCURATELY. AN EXAMPLE IS PRESENTED OF AN EXPERIMENTAL SYSTEM USED BY PHYSICIANS TO SELECT SETS OF LABORATORY TESTS. HIERARCHY CONSTRUCTION IS DISCUSSED, WITH CONSIDERATION OF BOTH OPTIMAL SEARCH STRATEGY AND THE SUBOPTIMAL STRATEGY ACTUALLY EMPLOYED BY MOST USERS. THE EFFECTS OF TOTAL VOCABULARY SIZE AND INDIVIDUAL LIST SIZE ARE SHOWN. DISPLAY FORMATTING, PARTICULARLY REAL-TIME AUTOMATIC DISPLAY FORMATTING, IS DISCUSSED IN THE CONTEXT OF THE EXAMPLE SYSTEM.

8P, 6R.

THIS IS ONE OF A NUMBER OF PAPERS WHICH ADVOCATE THE USE OF COMPUTER-INITIATED DIALOGUE USING A LIGHTPEN OR OTHER POINT-IN DEVICE. IT DISCUSSES THE USE OF SUCH A METHOD FOR BOTH COMMAND CONSTRUCTION AND HIERARCHIC SEARCH. OF MORE INTEREST IS THE AUTHORS' DISCUSSION OF VARIOUS CONSIDERATIONS IN THE FORMATTING OF DISPLAYS FOR THIS PURPOSE, AND OF THE CONSTRUCTION OF SUBLISTS FOR A HIERARCHIC SEARCH. THE AUTHORS ALSO ALLUDE TO AN UNPUBLISHED EMPIRICAL STUDY IN WHICH THEY FOUND THAT INEXPERIENCED SUBJECTS SEARCH A LIST SERIALLY FOR A PARTICULAR ITEM, EVEN THOUGH THE LIST WAS ALPHABETIZED AND COULD BE SEARCHED MUCH MORE EFFICIENTLY IN OTHER WAYS. THE PAPER DEMONSTRATES A WELL-INTEGRATED MENU-SELECTION TECHNIQUE, AND SHOULD BE OF INTEREST TO THOSE DESIGNING OR IMPLEMENTING SUCH A DIALOGUE, AS WELL AS THOSE DESIGNING DIALOGUES FOR MEDICAL INFORMATION SYSTEMS.

524 FACILITARY LAYOUT FOR NORAD INTERACTIVE SYSTEM VAN ARSDEL, J.H., SR. HUMAN FACTORS ROLE IN EQUIPMENT DEFINITION AND FACILITY LAYOUT FOR THE SPACE COMPUTATIONAL CENTER AND THE NORAD COMPUTER SYSTEM IMPROVEMENT PROGRAM. IN PROCEEDINGS OF THE 18TH ANNUAL MEETING OF THE HUMAN FACTORS SOCIETY. SANTA MONICA, CALIFORNIA: HUMAN FACTORS SOCIETY, 1974, 634-640.

DESCRIPTION:

THE PURPOSE OF THE 427M IMPROVEMENT PROGRAM IS TO REPLACE AND UPDATE THE COMPUTER, COMMUNICATIONS, AND DISPLAY FACILITY USED TO SUPPORT THE NORTH AMERICAN AIR DEFENSE COMMAND (NORAD) AND THE AEROSPACE DEFENSE COMMAND IN ACCOMPLISHING THEIR ASSIGNED MISSIONS, THROUGH 1980.

THE INTERFACE BETWEEN THE HUMAN OPERATORS AND THE SEVERAL COMPLETE COMPUTER SYSTEMS OF THE SPACE COMPUTATIONAL CENTER (SCC) AND NORAD IS THE INTERACTIVE DISPLAY CONSOLE. THE SCC/NCS (NORAD COMPUTER SYSTEM) GRAPHIC DISPLAY CONSOLE MUST MEET SPECIFIC AIR FORCE READABLITY, LOOK—ANGLE, ACCESSIBILITY, AND MAINTENANCE REQUIREMENTS, AS WELL AS THE RESTRICTIVE SPACE, WEIGHT, AND POWER REQUIREMENTS. BOTH THE SCC AND NCS DISPLAY PRESENTATIONS REQUIRE EXTENSIVE USE OF DISPLAY VECTORS TO CONSTRUCT MAPS AND BACKGROUNDS IN ADDITION TO PRESENTING THE DATA. THE PROBLEMS OF LEGIBILITY REQUIRE EVALUATING THE ADVANTAGES OF STROKE-GENERATION TECHNIQUES OVER THE RASTER-SCAN TECHNOLOGY IN PRODUCING STRAIGHT, CLEARLY DEFINED VECTORS. ALSO, THE SYSTEM REQUIRES A HIGHLY RELIABLE, MODULARLY EXPANDABLE, HIGH-THROUGHPUT SYSTEM WHICH WOULD APPLY TO BOTH THE SCC AND NCS MAN/MACHINE INTERFACE REQUIREMENTS. TO EFFECTIVELY MAINTAIN THE DISPLAY CONSOLE HARDWARE, IT SHOULD BE IDENTICAL FOR BOTH THE SCC AND NCS SEGMENTS; HOWEVER, THE SEGMENTS MUST BE ADDRESSABLE FOR DIFFERENT FUNCTIONAL OPERATIONS AND DISPLAYED INFORMATION. THUS, THE OPERATIONAL PARAMETERS WERE ASSIGNED TO SOFTWARE PROGRAMS.

FUNCTIONS OF THE SCC INCLUDE SPACE CATELOG MAINTENANCE, SPACE SENSOR SYSTEM STATUS, SPACE WEAPONS SUPPORT, SYSTEM CONTROL AND SUPPORT, PROGRAMMING SUPPORT, AND PERSONNEL SUBSYSTEM SUPPORT. TO PERFORM THESE FUNCTIONS WITHIN THE ALLOWABLE TIME CONSTRAINTS, A HIGHLY AUTOMATED AND HIGHLY INTERACTIVE COMUTER SYSTEM IS NEFDED.

HIGHLY INTERACTIVE COMUTER SYSTEM IS NEEDED.

THE HUMAN FACTORS ROLE IN CONSOLE DEFINITION, MAN/COMPUTER INTERFACE
CONSIDERATIONS, AND FACILITY LAYOUT PROBLEMS WILL BE DISCUSSED IN THE PAPER.
(A)

7P, 7R.

COMMENTS:

THIS PAPER PRESENTS A VERY LIMITED VIEW OF THE ROLE OF HUMAN FACTORS IN THE DESIGN OF INTERACTIVE SYSTEMS. THE AUTHOR CONCENTRATES ONLY ON HARDWARE PROBLEMS AND TREATS INDIVIDUAL PROBLEMS AS THEY ARISE RATHER THAN ATTEMPTING TO FORMULATE GUIDELINES OR USING EXISTING GUIDELINES. NO CONSIDERATION IS GIVEN TO SUCH QUESTIONS AS WHAT INFORMATION SHOULD BE PRESENTED TO THE OPERATOR OR HOW IT SHOULD BE PRESENTED. THESE APPEAR TO BE THE PRIMARY HUMAN FACTORS ISSUES IN THE DESIGN OF INTERACTIVE SYSTEMS. ALTHOUGH WORKPLACE DESIGN IS ALSO IMPORTANT, OF COURSE, IT SEEMS REASONABLE TO EXFECT THAT THE OPERATOR CAN OVERCOME PHYSICAL DEFICIENCIES IN EQUIPMENT MORE EASILY THAN DEFICIENCIES IN THE INFORMATION WITH WHICH HE IS PRESENTED OR THE TECHNIQUES AVAILABLE FOR MANIPULATING THAT INFORMATION.

PAPER SIMULATION AS USER REQUIREMENTS ANALYSIS METHOD
VAN COTT, H.P., & KINKADE, R.G. HUMAN SIMULATION APPLIED TO THE FUNCTIONAL
DESIGN OF INFORMATION SYSTEMS. HUMAN FACTORS, 1968, 10, 211-216.
DESCRIPTION:

THREE STUDIES USED HUMANS TO SIMULATE THE FUNCTIONS OF SCIENCE INFORMATION SYSTEMS. THE SIMULATED SYSTEMS WERE MADE AVAILABLE TO BIOCHEMIST USERS TO FULFILL THEIR INFORMATION NEEDS. THE REQUESTING BEHAVIOR OF THE USERS AND OF THE SIMULATED SYSTEM ELEMENTS IN RESPONSE TO REQUESTS WAS MEASURED WITH RESPECT TO A NUMBER OF VARIABLES (E.G., FREQUENCY, TIME, AND TYPE OF REQUESTS). THE RESULTS ARE INTERPRETED IN TERMS OF THEIR IMPLICATIONS FOR THE DESIGN OF IMPROVED SCIENCE INFORMATION SERVICES AND SYSTEMS AND THE FUNCTIONAL PROPERTIES THAT THESE SYSTEMS SHOULD HAVE TO MEET USER REQUIREMENTS. (A)

6P, 7R.

THIS STUDY ILLUSTRATES A SIMPLE APPLICATION OF MANUAL SIMULATION TECHNIQUES TO THE EARLY USER REQUIREMENTS ANALYSIS AND DESIGN PHASE OF COMPUTER SYSTEM DEVELOPMENT. THE SIMULATION WAS USED TO GAIN INFORMATION ABOUT THE NATURE OF PROBABLE USER REQUESTS AND TO EVALUATE THE BASIC SYSTEM CONCEPT PROPOSED FOR A BIOLOGICAL SCIENCES BIBLIOGRAPHIC SYSTEM. IT WAS ALSO USED TO VARY SOME PROPERTIES OF THE USER INTERFACE, BY ALLOWING THE USER TO TELEPHONE HIS REQUESTS TO A FELLOW SCIENTIST, A SECRETARY, OR A TAPE RECORDER. SIMPLE REQUESTS FOR SPECIFIC DOCUMENTS TENDED TO BE VERY EXPLICIT AND TO BE MADE TO THE SECRETARY OR TAPE RECORDER, BUT REQUESTS FOR BIBLIOGRAPHIC SEARCHES WERE MADE PRIMARILY TO THE TRAINED BIOLOGIST. THE CONCLUSION APPEARS WARRANTED THAT THE USER COULD INTERACT DIRECTLY WITH AN INTERACTIVE SYSTEM TO MAKE SPECIFIC DOCUMENT REQUESTS, BUT A TRAINED SEARCHER (OR A VERY "INTELLIGENT" SYSTEM) IS PROBABLY REQUIRED TO SATISFY HIS REQUESTS FOR BIBLIOGRAPHIC SEARCHES. THE METHOD USED HERE IS INEXPENSIVE, CAN PROVIDE CONSIDERABLE INFORMATION, AND SHOULD PROBABLY BE USED MORE WIDELY.

526 USER REQUIREMENTS ANALYSIS FOR MANAGEMENT INFORMATION SYSTEMS VANDERSLUIS, H.J. THE MAN-MACHINE INTERFACE FOR 1990 MANAGEMENT INFORMATION SYSTEM DISPLAYS (TECHNICAL REPORT AMCA-71-006). WASHINGTON, D.C.: ARMY ADVANCED MATERIEL CONCEPTS AGENCY, SEPTEMBER 1970. (NTIS NO. AD 712998) DESCRIPTION:

THE U.S. ARMY ADVANCED MATERIEL CONCEPTS AGENCY CONVENED AN AD HOC WORKING GROUP (AHMG) FOR THREE DAYS, 4-6 AUGUST 1970, TO DETERMINE WHAT COMPUTER-ASSOCIATED DISPLAY TECHNOLOGY SHOULD BE BROUGHT TO BEAR TO EXTEND AND EXPAND THE CAPABILITIES OF HIGH-LEVEL FIELD COMMANDERS. TO FOCUS THE STUDY, THE "COMMANDER" WAS ASSUMED TO BE THE COMMANDER IN CHIEF (CINC) OF A THEATER OF OPERATIONS, AND ONLY HIS FUNCTIONS RELATING TO COMBAT SERVICE SUPPORT WERE CONSIDERED. THE AHMG CONSIDERED FORMATS, FLEXIBILITY, ADAPTABILITY, DYNAMICS, PREDICTIVE CAPABILITY, DIRECTIVE FUNCTIONS, CREDIBILITY CONSIDERATIONS, AND OPERATING CHARACTERISTICS OF DISPLAYS. THE REPORT OF THE AHMG DESCRIBES A METHODOLOGY FORMULATED BY THE GROUP TO ANALYZE THE DISPLAY REQUIREMENTS OF THE COMMANDER. THE METHODOLOGY BEGINS WITH DEVELOPMENT OF SCENARIOS REPRESENTATIVE OF THE PRINCIPAL COMMAND-AND-CONTROL PROBLEMS OF HIGH-LEVEL COMMANDERS. FOR EACH SCENARIO, HUMAN AND ENVIRONMENTAL CONSTRAINTS ARE LISTED. BY COMPARING THESE CONSTRAINTS, INFORMATION-DISPLAY REQUIREMENTS ARE DERIVED. THE REPORT DESCRIBES THE GROUP'S USE OF THE METHODOLOGY THROUGH ONE COMPLETE SCENARIO AND LISTS THE DISPLAY REQUIREMENTS THAT WERE DERIVED. (A)

AN APPENDIX DISCUSSES THE DEVELOPMENT OF CONCEPTUAL USES OF GRAPHICAL DISPLAYS. EXAMPLES OF DISPLAYS THAT ENHANCE HUMAN CAPABILITIES ARE PRESENTED. A BIBLIOGRAPHY OF 43 SUGGESTED REFERENCES IS INCLUDED.

44P, DR.

THIS PAPER DESCRIBES AN INTERESTING AND FEASIBLE APPROACH TO THE DEFINITION OF INFORMATION DISPLAY REQUIREMENTS FOR SPECIFIC SITUATIONS. THIS METHODOLOGY INVOLVES DETERMINING THE STEPS THAT ARE INVOLVED IN SOLVING A PROBLEM AND THE HUMAN AND ENVIRONMENTAL CONSTRAINTS INHERENT IN EACH OF THESE STEPS. FROM THESE SOURCES OF INFORMATION, DISPLAY REQUIREMENTS ARE DERIVED. THE SUCCESS OF THIS TECHNIQUE, THEREFORE, DEPENDS ON THE ABILITY TO ACCURATELY DEFINE CONSTRAINTS AND PROBLEM-SOLVING PHASES. ALTHOUGH A GREAT DEAL OF RESEARCH HAS BEEN DONE IN THE FORMER AREA, VERY LITTLE HAS BEEN DONE IN THE LATTER. THIS TECHNIQUE IS BEST USED AS A PRELIMINARY STEP IN USER REQUIREMENTS ANALYSIS RATHER THAN AS THE ONLY STEP. WHILE THIS TECHNIQUE PROVIDES AN APPROPRIATE STARTING POINT, INPUT FROM THE POTENTIAL USERS OF A SYSTEM SHOULD BE SOUGHT AND USED TO REFINE THE SYSTEM REQUIREMENTS.

527 DETECTION AND CORRECTION OF DATA ENTRY ERRORS
VARLEY, T.C. DATA INPUT ERROR DETECTION AND CORRECTION PROCEDURES (TECHNICAL
REPORT NO. T-222). WASHINGTON, D.C.: GEORGE WASHINGTON UNIVERSITY, 1969,
(NTIS NO. AD 689365)

DESCRIPTION:

THIS STUDY IS AN EXAMINATION OF THE INPUT DATA ERROR PROBLEM IN COMPUTERIZED INFORMATION SYSTEMS. THE AREA OF CONCERN IS THE DETECTION AND CORRECTION OF INPUT DATA ERRORS RESULTING FROM HUMAN RECORDING DURING THE INITIAL COLLECTION OF THE DATA.

A SYSTEM FOR CLASSIFYING ERRORS BY TYPE IS DEVELOPED; ATTENTION IS PAID TO THE KINDS OF ERRORS WHICH CAN BE MADE OR INTRODUCED AT VARIOUS LEVELS IN THE DATA GENERATION-DATA PROCESSING CHAIN. THE STUDY DEVELOPS A SYSTEMATIC PROCEDURE -- A MODEL -- FOR EVALUATING VARIOUS ERROR DETECTION AND CORRECTION PROCEDURES. THE FINAL EVALUATION OF THE DETECTION AND CORRECTION PROCEDURES TO BE USED IS BASED ON COST. THIS IS NOT DISPLACEMENT COST, BUT COST ASSOCIATED WITH IMPROVED OPERATIONS THROUGH MORE ACCURATE INFORMATION.

THE VALUE OF INFORMATION IS THE WORTH OF THE DATA, AND THE WORTH OF THE DATA IS THE DATA ACCURACY PROBLEM. THE MAJOR CONTRIBUTOR TO DATA ACCURACY IS FORMAL PROCEDURES FOR INPUT ERROR DETECTION AND CORRECTION. THIS STUDY HAS DEVELOPED THESE FORMAL PROCEDURES. (A) 242P. 55R.

COMMENTS:

THE AUTHOR PROPOSES CLASSIFICATION SCHEMES FOR TYPES OF ERRORS AND DISCUSSES TECHNIQUES FOR ERROR DETECTION AND CORRECTION. THESE CONCEPTS ARE THEN INCORPORATED INTO A MODEL AND PROCEDURES FOR IMPROVING ERROR DETECTION AND CORRECTION. NO ATTEMPT IS MADE, HOWEVER, TO VALIDATE THIS MODEL AND PROCEDURES, AND THEIR USEFULNESS IS NOT OBVIOUS. THE MODEL IS IN THE FORM OF A CHECKLIST FROM WHICH VARIOUS ALTERNATIVE PROCEDURES ARE REMOVED FROM CONSIDERATION, PRIMARILY ON THE BASIS OF SUBJECTIVE DECISIONS.

528 ALPHANUMERIC SYMBOLS

VARTABEDIAN, A.G. EFFECTS OF PARAMETERS OF SYMBOL FORMATION ON LEGIBILITY. INFORMATION DISPLAY, MAY 1970, 7(5), 23-26. DESCRIPTION:

THE EFFECTS OF SEVERAL PARAMETERS OF SYMBOL FORMATION ON THE LEGIBILITY OF CRT DISPLAYS WERE STUDIED. THESE PARAMETERS WERE LETTER ORIENTATION, SLANTED VS UPRIGHT; LETTER GENERATION METHOD, DOT MATRIX VS STROKE; DOT MATRIX SIZE, 5X7 VS 7X9; AND DOT GEOMETRY, ELONGATED VS CIRCULAR DOTS. THENTY-SIX LETTERS AND TEN NUMBERS COMPRISED THE SYMBOL SET THAT WAS TESTED. THE 5X7 AND 7X9 SYMBOLS WERE DESIGNED FOR LEGIBILITY WHILE THE STROKE SYMBOLS WERE PATTERNED AFTER THE LEROY FONT.

SYMBOLS WERE PATTERNED AFTER THE LEROY FONT.

SYMBOLS WERE TESTED BY PRESENTING THEM BRIEFLY ON THE SCREEN OF THE DISPLAY WITH SUBJECTS ATTEMPTING TO IDENTIFY THE SYMBOL SHOWN. SPEED AND ACCURACY OF IDENTIFICATION WERE USED AS THE MEASURES OF LEGIBILITY.

RESULTS INDICATE THE 7X9 DOT MATRIX SYMBOLS DRAWN WITH CIRCULAR DOTS WERE SUPERIOR TO ALL OTHER SYMBOLS IN BOTH REACTION TIME AND ERROR MEASURES. SLANTING HAD A DETRIMENTAL EFFECT ON DOT AND STROKE SYMBOLS AND CIRCULAR DOT SYMBOLS WERE SUPERIOR TO ELONGATED DOT SYMBOLS.

4P, OR.

THIS IS A WELL-EXECUTED STUDY THAT COMPARES SYMBOL GENERATION METHOD, DOT MATRIX SIZE, DOT SHAPE, AND SYMBOL DRIENTATION. ALTHOUGH THE RESULTS ARE POSSIBLY CONFOUNDED DUE TO THE NECESSITY OF USING TWO DIFFERENT DISPLAY CONSOLES TO ACCOMMODATE THE SYMBOL TYPES STUDIED, THE AUTHOR ATTEMPTS TO MINIMIZE THIS EFFECT. IT IS INTERESTING TO MOTE THAT SUBJECT PREFERENCES DO NOT CORRESPOND TO OBSERVED PERFORMANCE.

529 CURSORS FOR ALPHANUMERIC DISPLAYS

VARTABEDIAN, A.G. HUMAN FACTORS EVALUATION OF SEVERAL CURSOR FORMS FOR USE ON ALPHANUMERIC CRT DISPLAYS. IEEE TRANSACTIONS ON MAN-MACHINE SYSTEMS, 1970, MMS-11, 132-137.

DESCRIPTION:

THE RESULTS OF AN EXPERIMENT TO EVALUATE SEVERAL CURSOR FORMS FOR USE ON ALPHANUMERIC CRT DISPLAYS ARE PRESENTED. CURSOR FORM AND CURSOR BLINK RATE WERE INVESTIGATED IN TERMS OF THEIR EFFECT ON OPERATOR SEARCH TIME IN FINDING THE CURSOR IN A RANDOM LOCATION AND THEIR EFFECTS ON TRACKING THE CURSOR AS IT IS MOVED BETWEEN FIXED RANDOM LOCATIONS. SIX CURSOR FORMS AT FIVE ALTERNATION RATES WERE EXAMINED. THE CURSOR FORMS WERE BOX, UNDERLINE, CROSS, DIAMOND, BLINKING, AND MIGGLING CURSORS. ALTERNATION RATES WERE 0, 2, 3, 5, AND 6 HZ. BASED ON RESULTS AND ADDITIONAL CRITERIA ABOUT THE USE OF CATHODE-RAY-TUBE DISPLAYS, IT WAS DETERMINED THAT, OF THE CURSORS EXAMINED, A BOX CURSOR AROUND EACH GRAPHIC CHARACTER BLINKING AT 3 HZ IS MOST EFFECTIVELY SEARCHED AND TRACKED. SUBJECTIVE EVALUATIONS SUPPORT THIS FINDING. (A)

COMMENTS:

THIS IS A DETAILED, WELL EXECUTED STUDY OF A SMALL BUT SIGNIFICANT ASPECT OF CRT DISPLAYS. THE PAPER DISCUSSES THE RELEVANT FACTORS WELL, AND THE EXPERIMENT SEEMS TO HAVE INCLUDED A NICELY REPRESENTATIVE SET OF CANDIDATE CURSOR TYPES. THE REPORTING OF SEPARATE RESPONSE TIME DATA FOR THE SEARCH AND MOVE PORTIONS OF THE EXPERIMENTAL TASKS MAKES IT FAIRLY EASY TO SEE WHY THE VARIOUS CURSORS AND BLINK RATES HAD THE OBSERVED EFFECTS ON PERFORMANCE. AT THE RISK OF NITPICKING, INTERPOLATION OF THE AUTHOR'S DATA WOULD SUGGEST THAT A BOX CURSOR AT 4HZ MIGHT BE SLIGHTLY PREFERABLE. THIS PAPER SHOULD BE READ BY THOSE CONCERNED WITH THE FUNCTIONAL PROPERTIES OF CRT TERMINALS (EITHER FOR PURPOSES OF DESIGN OR SELECTION). SUCH FACTORS AS CURSOR PROPERTIES ARE BECOMING MORE READILY MODIFIABLE AS INTELLIGENT TERMINALS AND MICROPROGRAMMABLE TERMINALS BECOME MORE COMMON.

530 ALPHANUMERIC SYMBOLS

VARTABEDIAN, A.G. THE EFFECTS OF LETTER SIZE, CASE, AND GENERATION METHOD ON CRT DISPLAY SEARCH TIME. HUMAN FACTORS, 1971, 13, 363-368.

DESCRIPTION:

THE EFFECTS OF LETTER SIZE, CASE, AND GENERATION METHOD WERE STUDIED IN A TASK OF SEARCHING FOR A COMMON FIVE-LETTER WORD IN A CRT DISPLAY. SYMBOL SIZES OF 0.12, 0.14, AND 0.16 IN. WERE EVALUATED. WORDS WERE COMPOSED OF ALL UPPERCASE OR ALL LOWERCASE LETTERS. TWO SYMBOL GENERATION METHODS —— LETTERS DRAWN BY MEANS OF CONTINUOUS STROKES AND BY MEANS OF A SEVEN-WIDE-BY-NINE-HIGH PATTERN OF DOTS IN A FIXED MATRIX —— WERE INVESTIGATED. THE RESULTS INDICATED THAT FOR BOTH METHODS OF SYMBOL GENERATION, UPPERCASE WORDS WERE SEARCHED 13% FASTER THAN LOWERCASE WORDS. NO SIGNIFICANT DIFFERENCES WERE FOUND DUE TO SYMBOL GENERATION METHOD OR LETTER SIZE. (A)

6P, 5R.

THIS IS A SIMPLE, WELL EXECUTED STUDY INVESTIGATING VARIOUS PROPERTIES OF ALPHANUMERIC CHARACTERS ON CRT DISPLAYS. THE RESULTS SUGGEST THAT, WITH APPROPRIATE ATTENTION TO BEAM DIAMETER AND CHARACTER PROPERTIES, EITHER DOT OR STROKE GENERATION CAN BE USED EFFECTIVELY IN SEARCH TASKS. THE RESULTS ALSO INDICATE THAT ALL—UPPER-CASE DISPLAYS ARE PREFERABLE TO ALL-LOWER-CASE DISPLAYS FOR VISUAL SEARCH, ALTHOUGH IT IS POSSIBLE THAT THIS PREFERENCE MIGHT BE REDUCED BY MANIPULATION OF FONT PROPERTIES AND INTERCHARACTER SPACING. IN ANY EVENT, THIS RESULT IS NOT GENERALIZABLE TO OTHER DISPLAY USES THAN VISUAL SEARCH; SPECIFICALLY, IT SHOULD NOT BE CONCLUDED THAT UPPER-CASE DISPLAYS ARE PREFERABLE FOR TEXT READING, WHERE THE OPPOSITE RESULT MOULD PROBABLY BE OBTAINED.

DESIGN OF AIDS FOR DECISION-MAKING TASKS
VAUGHAN, W.S., JR., & MAVOR, A.S. BEHAVIOURAL CHARACTERISTICS OF MEN IN THE
PERFORMANCE OF SOME DECISION-MAKING TASK COMPONENTS. ERGONOMICS, 1972, 15,
267-277.

#### DESCRIPTION:

COMPUTER TECHNOLOGY HAS MADE A CONVERSATIONALLY INTERACTIVE SYSTEM CONCEPT FEASIBLE, BUT THE USER-ORIENTED DISCIPLINES HAVE NOT YET ABANDONED THE MAN VS. MACHINE TASK ALLOCATION ORIENTATION IN FAVOUR OF MAN-WITH-A-COMPUTER CDNCEPT OF PERFORMING COMPLEX COGNITIVE WORK. GUIDELINES FOR APPLICATION OF INTERACTIVE COMPUTER SYSTEMS DEPEND ON (1) A KNOWLEDGE OF THE KINDS OF SUBTASKS EXPERIENCED DECISION MAKERS PERFORM WHEN THEY DO THEIR JOBS, AND (2) THE CHARACTERISTICS OF THEIR PERFORMANCE IN EACH SUBTASK.

EMPIRICAL RESEARCH WITH EXPERIENCED, PROFESSIONAL DECISION MAKERS IS REVIEWED TO DEFINE SUSTASKS AND TO DOCUMENT PERFORMANCE CHARACTERISTICS. IMPLICATIONS OF MAN'S KNOWN PERFORMANCE CHARACTERISTICS ARE TRACED OUT TO GENERAL RECOMMENDATIONS FOR DESIGN OF INTERACTIVE SYSTEMS. (A) 11P, 34R.

#### COMMENTS:

IN ORDER TO OBTAIN A TRULY SYMBIOTIC RELATIONSHIP BETWEEN MAN AND MACHINE IT IS NECESSARY TO UNDERSTAND HOW MAN PERFORMS HIS TASK SO THAT THE MACHINE CAN COMPENSATE FOR HIS WEAKNESSES AND MAXIMIZE HIS STRENGTHS. THIS PAPER REVIEWS EMPIRICAL RESEARCH RELATED TO THE COGNITIVE ASPECTS OF DECISION—MAKING AND PRESENTS A TAXONOMY OF THE CATEGORIES OF BEHAVIOR INVOLVED IN DECISION MAKING. ON THE BASIS OF THIS REVIEW, SEVERAL GUIDELINES FOR THE FUNCTIONAL PROPERTIES OF INTERACTIVE SYSTEMS TO AID DECISION—MAKING ARE PROPOSED. THESE GUIDELINES APPEAR TO BE THEORETICALLY SOUND AND INDICATE AREAS WHERE ADDITIONAL RESEARCH IS NEEDED.

532 GRAPHICAL VERSUS ALPHANUMERIC TACTICAL SITUATION DISPLAYS
VICINO, F.L., & RINGEL, S. DECISION MAKING WITH UPDATED GRAPHIC VS
ALPHA-NUMERIC INFORMATION (TECHNICAL RESEARCH NOTE 178). WASHINGTON, D.C.:
ARMY PERSONNEL RESEARCH DFFICE, NOVEMBER 1966. (NTIS NO. AD 647623)
DESCRIPTION:

TO KEEP PACE WITH TECHNOLOGICAL ADVANCEMENTS IN MILITARY OPERATIONS AND TO MEET THE NEED OF COMMANDERS TO MAKE TACTICAL DECISIONS CONSISTENT WITH RAPID CHANGES OF EVENTS, THE ARMY IS DEVELOPING AUTOMATED SYSTEMS FOR RECEIPT, STORAGE, RETRIEVAL, AND DISPLAY OF DIFFERENT TYPES AND VAST AMOUNTS OF MILITARY DATA. AS PART OF THE REQUIREMENTS FOR RESEARCH, STUDIES HAVE BEEN CONDUCTED BY THE COMMAND SYSTEMS TASK BEARING UPON FACILITATION OF DECISION MAKING AND INFORMATION ASSIMILATION FROM DISPLAYS. THE PRESENT STUDY IS CONCERNED WITH THE EFFECTS OF ALPHANUMERIC AND GRAPHIC PRESENTATION OF INFORMATION ON THE ACCURACY AND TIMELINESS OF DECISION MAKING AND CONFIDENCE IN THE DECISION MADE. THESE VARIABLES WERE EXAMINED IN THE CONTEXT OF A SIMULATED CONSTANTLY CHANGING BATTLEFIELD SITUATION. A SERIES OF SLIDES DEPICTING BATTLEFIELD INFORMATION WERE PRESENTED BOTH ALPHANUMERICALLY AND GRAPHICALLY TO SUBJECTS. EACH SUBJECT WAS ASKED TO MAKE A DECISION AS TO THE ENEMY FORCES ACTIVITY AND TO EXPRESS HIS CONFIDENCE IN HIS DECISION IN TERMS OF PROBABILITY ODDS. ALSO, FOR EACH MODE OF DISPLAY, THE SEQUENCE OF INFORMATION WAS PRESENTED AT TWO DIFFERENT RATES OF UPDATING—7 VS 14 UPDATED SLIDES. NO DIFFERENCES WERE FOUND BETWEEN ALPHANUMERIC AND GRAPHIC PRESENTATION IN TERMS OF QUALITY OR TIMELINESS OF DECISION OR IN CONFIDENCE SCORE; NOR WERE THEY FOUND IN RESULTS WITH THE TWO RATES OF UPDATING.

GREATER SHIFTS IN LEVEL OF CONFIDENCE WERE SHOWN, FOR BOTH MODES OF PRESENTATION, FROM SLIDE TO SLIDE IN THE 7-SLIDE UPDATING THAN IN THE 14-SLIDE UPDATING. RESULTS ALSO SHOWED THAT, ON THE AVERAGE, SUBJECTS WHOSE FINAL DECISION WAS CORRECT HAD MADE THE CORRECT RESPONSE THREE-FOURTHS OF THE WAY TO THEIR FINAL DECISION.

FINDINGS ENCOUNTERED SUGGEST FURTHER RESEARCH IS NEEDED FOR INFORMATION ON RATE OF UPDATING LIMITS AND ON FACTORS AND WORK METHODS WHICH INCREASE CONFIDENCE IN DECISION ALONG WITH QUALITY OF DECISION. (A) 24P. 5R.

#### COMMENTS:

THIS IS A FAIRLY STRAIGHTFORWARD EXPERIMENTAL COMPARISON AND IT APPEARS TO HAVE BEEN, WITH ONE EXCEPTION, CAREFULLY CONDUCTED. THIS EXCEPTION CONCERNS THE SUBJECT POPULATION. WHILE THE EXPERIMENTAL MATERIALS MAY ACCURATELY REFLECT INFORMATION ENCOUNTERED IN TACTICAL OPERATIONS CENTERS, SUBJECTS HAD HAD NO PREVIOUS EXPERIENCE WITH THIS TYPE OF TASK. THE OVERALL LACK OF SIGNIFICANT RESULTS, THEREFORE, MAY BE DUE TO SUBJECTS' LACK OF FAMILIARITY WITH THE TASK RATHER THAN TO THE INDEPENDENT VARIABLES MANIPULATED.

533 COMPLEXITY OF DISPLAYS VITZ, P.C. PREFERENCE FOR DIFFERENT AMOUNTS OF VISUAL COMPLEXITY. BEHAVIORAL SCIENCE, 1966, 11, 105-114. DESCRIPTION:

IN THIS ARTICLE ARE REPORTED THO STUDIES CARRIED OUT TO TEST THE HYPOTHESIS THAT SUBJECTS PREFER A SPECIFIC DEGREE OF VISUAL COMPLEXITY. ANGULAR PATTERNS OF INCREASING COMPLEXITY WERE PRESENTED TO SUBJECTS. RESULTS OF THESE TESTS SHOWED THAT THE AVERAGE CURVE OF PREFERENCE INCREASED UP TO A MODERATE DEGREE OF COMPLEXITY AND THEN DECREASED. (0) 10P, 16R.

COMMENTS: THE TWO EXPERIMENTS REPORTED HERE ARE CLEARLY REPORTED AND APPEAR TO HAVE BEEN CAREFULLY CONDUCTED. THESE EXPERIMENTS INDICATE THAT SUBJECTS HAVE OPTIMAL, OR PREFERRED, AMOUNTS OF VISUAL COMPLEXITY AND SUGGEST THAT THE AMOUNT OF PREFERRED COMPLEXITY MAY INCREASE WITH EXPOSURE TO A GIVEN SET OF VISUAL STIMULI. THESE RESULTS SEEM REASONABLE AND SHOULD APPLY TO A WIDE RANGE OF VISUAL DISPLAYS. THE DATA ALSO INDICATE LARGE INDIVIDUAL DIFFERENCES IN THE PREFERRED AMOUNT OF COMPLEXITY. THESE STUDIES MEASURED ONLY SUBJECT PREFERENCE AND DID NOT ATTEMPT TO ASSESS PERFORMANCE. IN STUDIES OF COLOR CODING, FOR EXAMPLE, IT IS SOMETIMES OBSERVED THAT SUBJECTS PREFER THE ADDITION OF COLOR EVEN THOUGH IT DOES NOT IMPROVE OR MAY EVEN DEGRADE PERFORMANCE. THE RELATIONS BETWEEN USER PREFERENCE AND PERFORMANCE ARE, UNDOUBTEDLY, BOTH VERY COMPLEX AND IMPORTANT IN DISPLAY DESIGN.
ALTHOUGH THIS PAPER OFFERS SOME INTERESTING CONCEPTS ON USER ACCEPTANCE
ASPECTS OF VISUAL DISPLAYS AND NUMEROUS OTHER PAPERS CONSIDER PERFORMANCE
ASPECTS, THE INTEGRATION OF BOTH ACCEPTANCE AND PERFORMANCE ASPECTS INTO A

534 THREE-DIMENSIONAL DISPLAYS VLAHOS, P. THE THREE-DIMENSIONAL DISPLAY: ITS CUES AND TECHNIQUES. INFORMATION DISPLAY, NOVEMBER-DECEMBER 1965, 2(6), PP. 10; 13-20. DESCRIPTION:

SINGLE THEORETICAL FRAMEWORK MAY PROVE TO BE A VERY DIFFICULT TASK.

THIS PAPER DESCRIBES THE BASIC VISUAL CUES WHICH CAUSE THE OBSERVER TO PERCEIVE A DISPLAY AS THREE-DIMENSIONAL. SEVERAL TECHNIQUES FOR 3-D DISPLAY ARE DESCRIBED, AND THE CUES AND "ANTI-CUES" ASSOCIATED WITH PARTICULAR DISPLAY TECHNIQUES ARE DISCUSSED. 9P, 7R.

COMMENTS:

THE AUTHOR DOES A GOOD JOB OF RELATING VISUAL DEPTH CUES TO THREE-DIMENSIONAL DISPLAYS, AND THIS ARTICLE MAY BE PREFERABLE, FOR THAT REASON, TO STANDARD VISION TEXTBOOKS WHICH DISCUSS THE DEPTH CUES IN AN ABSTRACT WAY. ALTHOUGH THE STATE OF THE ART IN THREE-DIMENSIONAL DISPLAYS HAS ADVANCED SOMEWHAT SINCE THIS ARTICLE, THE DISCUSSION OF DEPTH CUES IS NOT DATED. THE ARTICLE IS OF INTEREST TO THOSE INVOLVED IN TRUE 3-D DISPLAYS, BUT ALSO TO THOSE ATTEMPTING TO CONVEY EVEN MINIMAL 3-D INFORMATION IN TWO-DIMENSIONAL DISPLAYS.

NATURAL-LANGUAGE DIALDGUE IN INFORMATION RETRIEVAL SYSTEMS
VON FOERSTER, H. TOWARD DIRECT ACCESS INTELLIGENCE SYSTEMS. URBANA, ILLINOIS:
UNIVERSITY OF ILLINOIS, BIOLOGICAL COMPUTER LABORATORY, DECEMBER 1970. (NTIS NO. AD 718062)

DESCRIPTION: IN CONTRAST TO CONVENTIONAL SO CALLED "INFORMATION STORAGE AND RETRIEVAL SYSTEMS" WHICH DE FACTO STORE INDEXED DOCUMENTS (THE DATA BASE) WHICH UPON RETRIEVAL MAY OR MAY NOT CONTAIN THE INFORMATION NEEDED BY THE QUERIER WHO IS TO ADDRESS SUCH SYSTEMS THROUGH HIGHLY RESTRICTED AND ARTIFICIAL INDEXING LANGUAGES, THIS PROJECT AIMS AT THE DEVELOPMENT OF A DATA BASE WHICH ORGANIZES THE INTELLIGENCE STORED IN A MACHINE SUCH THAT THE DESIRED KNOWLEDGE IS DIRECTLY ACCESSIBLE TO THE USER THROUGH A MANMACHINE DIALOGUE IN THE USER'S NATURAL LANGUAGE. THE FEASIBILITY OF THIS APPROACH TO DIRECT ACCESS INYELLIGENCE SYSTEMS (DAIS) IS STRONGLY INDICATED BY RECENT RESULTS OBTAINED BY VARIOUS INVESTIGATORS IN THE DEVELOPMENT OF RELATIONAL DATA STRUCTURES AND INTERACTING MACHINE PROGRAMS WHICH PERMIT COMPUTING IN THE SEMANTIC DOMAIN, AND IN LOGIC, THEORY AND EXPERIMENTAL STUDIES OF COGNITIVE PROCESSES IN LIVING ORGANISMS.

CONSEQUENTLY, IT WAS PROPOSED TO CONTINUE AND TO COMPLETE THE RESEARCH AND DEVELOPMENT OF THE CONCEPTUAL, THEORETICAL AND TECHNOLOGICAL FOUNDATIONS FOR THE DEVELOPMENT OF MACHINE INTELLIGENCE SYSTEMS WITH DIRECT ACCESS TO A USER'S DESIRED KNOWLEDGE VIA A MAN-MACHINE DIALOGUE IN THE USER'S NATURAL LANGUAGE. (A, ABBR.) 23P, 54R.

COMMENTS:

THIS PAPER DESCRIBES AN INTERESTING ATTEMPT TO APPLY THEORIES AND TECHNIQUES DERIVED FROM PSYCHOLOGY, LOGIC, AND ARTIFICIAL INTELLIGENCE TO THE DESIGN OF AN INFORMATION RETRIEVAL SYSTEM. THE RELEVANCE OF THESE AREAS IS FAIRLY CONVINCINGLY DEMONSTRATED. THERE ARE SEVERAL PROBLEMS, HOWEVER, WITH DIRECTLY APPLYING STATE-OF-THE-ART THEORIES. THE AUTHOR IDENTIFIES SOME OF THESE PROBLEMS AND ILLUSTRATES THE ADVANTAGES THAT COULD BE OBTAINED IF SOLUTIONS ARE FOUND.

536 COLOR CODING BIBLIOGRAPHY

JAGNER, D.W. COLOR CODING: AN ANNOTATED BIBLIOGRAPHY (TECHNICAL REPORT NO. NHC-TP-5922) . CHINA LAKE, CALIFORNIA: NAVAL WEAPONS CENTER, MARCH 1977. NO. AD A041061)

DESCRIPTION:

FIFTY-SEVEN DOCUMENTS WERE ANNOTATED FOR THE PURPOSE OF PRESENTING CURRENT INFORMATION ON COLOR CODING RESEARCH AND COLOR APPLICATIONS. THIS SELECTIVE REVIEW INCLUDES, IN ADDITION TO A WRITTEN SUMMARY OF THE WORK, FIGURES AND TABLES FROM MANY OF THE PUBLICATIONS TO GRAPHICALLY ILLUSTRATE OR CLARIFY KEY POINTS. 58P, 57R.

COMMENTS:

THIS DOCUMENT MAY BE A GOOD SOURCE PAPER FOR THOSE INTERESTED IN COLOR CODING. WHILE THIS REVIEW IS LESS COMPREHENSIVE THAN THAT CONTAINED IN R.E. CHRIST (1975), ITS SCOPE OF COVERAGE IS SOMEWHAT BROADER. THE CITED ARTICLES ARE DESCRIBED ONLY BRIEFLY AND THERE IS NO ATTEMPT TO CONSOLIDATE OR INTEGRATE THIS LITERATURE. A SUBJECT INDEX IS INCLUDED TO AID IN FINDING REFERENCES IN A GIVEN AREA OF INTEREST.

537 "KNOWLEDGE-BASED" APPROACH TO MAN-COMPUTER DIALOGUE
WAKSMAN, A. THE INTERFACE PROBLEM IN INTERACTIVE SYSTEMS. BEHAVIOR
RESEARCH METHODS AND INSTRUMENTATION, 1974, 6, 235-236.
DESCRIPTION:

ON-LINE COMPUTING IMPLIES A MAN-MACHINE DIALOGUE. IT COULD BE LOOKED AT AS A COMMUNICATION CHANNEL WITH BUILT-IN CONSTRAINTS. WE SEE A NEED TO STUDY IN A SYSTEMATIC WAY HOW SUCH CONSTRAINTS MODIFY HUMAN BEHAVIOR. SUCH STUDIES WILL FACILITATE THE WEEDED SPECIFICATION FOR EFFECTIVE STRATEGIES IN MAN-MACHINE COMMUNICATION. (A) 2P. 1R.

COMMENTS:

THIS PAPER DISCUSSES THE "KNOWLEDGE BASE SYSTEMS APPROACH" AS A POTENTIAL TECHNIQUE FOR IMPROVING THE MAN-MACHINE INTERFACE. BASICALLY, THIS APPROACH INVOLVES THE CONSTRUCTION OF A DATA BASE CONTAINING INFORMATION ABOUT THE USER AND THE WAYS HE USES THE SYSTEM. SUCH A MODEL OF THE USER ALLOWS THE SYSTEM TO RESOLVE SEMANTIC AMBIGUITIES, MAKE INFERENCES, ETC. PRELIMINARY VERSIONS OF SUCH A SYSTEM HAVE BEEN IMPLEMENTED. THE DEVELOPMENT OF MORE EFFECTIVE SYSTEMS, HOWEVER, REQUIRES ADDITIONAL RESEARCH ON THE COGNITIVE PROCESSES INVOLVED IN INFORMATION REPRESENTATION AND PROBLEM SOLVING. THIS CONCEPT APPEARS TO BE THEORETICALLY SOUND AND IT SHOULD BE OF INTEREST TO ANYONE CONCERNED WITH INTERACTIVE SYSTEMS OR INTERFACE DESIGN.

538 VIRTUAL GRAPHICAL INPUT DEVICES
WALLACE, V.L. THE SEMANTICS OF GRAPHIC INPUT DEVICES. IN PROCEEDINGS, ACM
SYMPOSIUM ON GRAPHIC LANGUAGES, SIGPLAN NOTICES, JUNE 1976, 11(6), 61-65.
DESCRIPTION:

ALL INPUT DEVICES FOR INTERACTIVE COMPUTER GRAPHICS CAN BE EFFECTIVELY MODELLED IN PROGRAMS BY A SMALL NUMBER OF VIRTUAL INPUT DEVICES. BY SPECIFYING AN APPROPRIATE SET OF SUCH VIRTUAL DEVICES, THE SEMANTICS OF INTERACTIVE INPUT CAN BE DEFINED INDEPENDENTLY OF THE PHYSICAL FORM OF THE DEVICES. IN THE SERVICE OF PROGRAM PORTABILITY, HUMAN FACTORS ADAPTABILITY, ECONOMY, AND MAXIMAL USE OF TERMINAL CAPABILITY, A SUFFICIENT SET OF VIRTUAL DEVICES IS DESCRIBED. (A) 5P, 8R.

COMMENTS:

THE LARGE NUMBER OF GRAPHICAL INPUT DEVICES THAT ARE CURRENTLY AVAILABLE OR THAT COULD BE DEVELOPED POSES A SERIOUS PROBLEM FOR THE PROGRAMMER OF A GRAPHICS APPLICATION PROGRAM WHO WANTS TO CREATE AN EFFICIENT AND PORTABLE PROGRAM. THE SUGGESTION OFFERED IN THIS PAPER OF PROGRAMMING TO ACCOMMODATE A SMALL NUMBER OF PRIMITIVE INPUT DEVICES AND DEFINING AVAILABLE INPUT DEVICES IN TERMS OF THESE PRIMITIVE DEVICES APPEARS REASONABLE. THIS SHOULD ALSO SIMPLIFY THE TASK OF INCORPORATING HUMAN FACTORS GUIDELINES INTO THE USER-PROGRAM INTERFACE, ALTHOUGH HUMAN FACTORS ISSUES RELATED TO THE ULTIMATE INPUT DEVICES TO BE USED MAY STILL REMAIN A PROBLEM.

539 EVALUATION OF MULTIPLE-CRITERION DECISION AIDING SYSTEM WALLENIUS, J., & ZIONTS, S. SOME TESTS OF AN INTERACTIVE PROGRAMMING METHOD FOR MULTICRITERION OPTIMIZATION AND AN ATTEMPT AT IMPLEMENTATION (WORKING PAPER 75-3). BRUSSELS, BELGIUM: EUROPEAN INSTITUTE FOR ADVANCED STUDIES IN MANAGEMENT, JANUARY 1975.
DESCRIPTION:

THIS PAPER DESCRIBES AN ATTEMPT TO APPLY IN PRACTICE AND TEST A MULTIPLE CRITERIA METHOD RECENTLY DEVELOPED BY THE AUTHORS. THE TEST WAS CONDUCTED IN A LARGE COMPANY ON A CORPORATE PLANNING PROBLEM INVOLVING MULTIPLE OBJECTIVES. TWO SIMPLIFIED LINEAR PROGRAMMING MODELS ASSUMING A LINEAR UTILITY FUNCTION OF THE OBJECTIVES WERE DEVELOPED. TWO MANAGERS EXPERIENCED IN MAKING THE KIND OF JUDGEMENTS REQUIRED PARTICIPATED IN THE EXPERIMENT AND INDIVIDUALLY USED THE METHOD TO SOLVE THE PROBLEM. THE RESULTS OF THE TEST ARE DESCRIBED, AND THE MAIN FEATURES OF THE MODELS AND THE COMPUTATIONAL SYSTEM TO IMPLEMENT THE METHOD ARE DISCUSSED. (A) 26P, 11R.

COMMENTS:

THE PRIMARY EMPHASIS OF THIS PAPER IS ON A TECHNIQUE FOR AIDING MANAGERS IN DETERMINING ACCEPTABLE SOLUTIONS TO MULTIPLE-CRITERION PROBLEMS. ALTHOUGH THE SUCCESS OF SUCH TECHNIQUES DEPENDS ON THE SPECIFIC ALGORITHM USED TO GENERATE ALTERNATIVE SOLUTIONS, THE AUTHORS OF INIS PAPER DO NOT DISCUSS THE ALGORITHM USED IN ANY DETAIL. THE PRIMARY ADVANTAGES OF A DECISION-AIDING SYSTEM, SUCH AS THAT PROPOSED HERE, ARE TO PRESENT ALTERNATIVES THAT THE DECISION MAKER MIGHT NOT OTHERWISE CONSIDER AND TO CHECK THE CONSISTENCY OF THE DECISION MAKER'S JUDGMENTS OF PRESENTED ALTERNATIVES. IT IS NOT CLEAR, ON THE BASIS OF THIS PAPER, WHETHER THE PROPOSED TECHNIQUE MEETS THESE OBJECTIVES. ADDITIONAL CONTROLLED RESEARCH IS CLEARLY NEEDED WITH THIS AND SIMILAR TECHNIQUES FOR AIDING MULTIPLE-CRITERION DECISION MAKING. THIS PAPER DOES CONTAIN SOME IDEAS, HOWEVER, THAT MAY BE OF INTEREST TO THOSE CONCERNED WITH AIDS FOR DECISION MAKING.

540 GENERAL
WALTHER, G.H. THE ON-LINE USER-COMPUTER INTERFACE: THE EFFECTS OF INTERFACE
FLEXIBILITY, EXPERIENCE, AND TERMINAL-TYPE ON USER-SATISFACTION AND
PERFORMANCE. COLORADO SPRINGS, COLORADO: U.S. AIR FORCE ACADEMY, DEPARTMENT OF
ASTRONAUTICS AND COMPUTER SCIENCE, AUGUST 1973 (ALSO DOCTORAL DISSERTATION,

UNIVERSITY OF TEXAS, AUSTIN, TEXAS, 1973). (NTIS NO. AD 777314)

DESCRIPTION:

THERE HAS BEEN A RECENT RECOGNITION BY SYSTEMS DESIGNERS OF THE NECESSITY FOR CONSIDERING THE NEEDS AND PREFERENCES OF THE USER OF ON-LINE COMPUTERS. VERY LITTLE EMPIRICAL EVIDENCE EXISTS FOR GUIDING "USER-ORIENTED" DESIGN EFFORTS. IN THIS STUDY, TWO LEVELS OF INTERFACE FLEXIBILITY, THE USER'S PRIOR EXPERIENCE ON-LINE, AND TERMINAL TYPE WERE INVESTIGATED AS POSSIBLE DETERMINANTS OF USER SATISIFACTION AND PERFORMANCE. THE TASK CONSISTED OF TEXT CORRECTION WITH AN ON-LINE TEXT EDITOR. A GENERAL LINEAR MODELS STATISTICAL TECHNIQUE CONTROLLED FOR THE EFFECTS OF MEASURABLE BUT UNCONTROLLABLE VARIABLES. INTERFACE FLEXIBILITY, OPERATIONALIZED AS ALTERNATIVES TO THE USER, IS NOT UNIFORMLY EFFECTIVE IN PRODUCING OPTIMAL PERFORMANCE FOR ALL USERS, NOR IN PRODUCING OPTIMAL PERFORMANCE FOR ALL USERS, NOR IN PRODUCING OPTIMAL PERFCEPTIONS OF SATISFACTION. AN ATTEMPT WAS MADE TO SPECIFY THE KINDS OF USERS FOR WHOM FLEXIBILITY IS "BEST". (A) 253P, 75R.

COMMENTS:

THIS IS, IN GENERAL, AN EXCELLENT EXPERIMENT. THE AUTHOR DEFINED A VERY REALISTIC AND INTERESTING TASK DOMAIN, IDENTIFIED A LARGE NUMBER OF POTENTIALLY RELEVANT INDEPENDENT AND DEPENDENT VARIABLES, AND CONDUCTED A VERY WELL CONTROLLED EXPERIMENT. AN INTRODUCTORY CHAPTER PROVIDES A CONCISE, ALTHOUGH FAIRLY THOROUGH, DISCUSSION OF INTERACTIVE SYSTEMS, TERMINALS, AND USER PERFORMANCE AND SATISFACTION. THE AUTHOR PROVIDES A GOOD DISCUSSION OF THE TYPES OF USERS THAT COULD MOST BENEFIT FROM A FLEXIBLE INTERFACE AND GIVES A GOOD CRITIQUE OF HIS RESEARCH. A POSSIBLE CRITICISM OF THIS RESEARCH IS THAT SUBJECT'S PRIOR EXPERIENCES WERE PRIMARILY WITH BATCH SYSTEMS AND THE NOVELTY OF USING AN INTERACTIVE SYSTEM MAY HAVE ENHANCED OVERALL PERFORMANCE AND DECREASED ANY EFFECTS DUE TO THE EXPERIMENTAL MANIPULATIONS. THIS IS ALSO CONSIDERED BY THE AUTHOR, HOWEVER.

541 EFFECTS OF INTERFACE FLEXIBILITY ON USER PERFORMANCE
WALTHER, G.M., & O'NEIL, H.F., JR. ON-LINE USER-COMPUTER INTERFACE: THE
EFFECTS OF INTERFACE FLEXIBILITY, TERMINAL TYPE, AND EXPERIENCE ON PERFORMANCE.
AFIPS CONFERENCE PROCEEDINGS, 1974, 43, 379-384.
DESCRIPTION:

BY ITS VERY NATURE, ON-LINE COMPUTING THRUSTS THE USER INTO AN ENTIRELY DIFFERENT ENVIRONMENT THAN DOES CONVENTIONAL BATCH PROCESSING. THE PROBLEMS INHERENT IN A PERSON'S BEING MADE A SYSTEM COMPONENT -- IN A SENSE AN EXTENSION OF THE COMPUTER HARDWARE -- WERE LARGELY IGNORED UNTIL QUITE RECENTLY. A REVIEW OF THE LITERATURE CLEARLY INDICATES THAT A SHIFT OF EMPHASIS IS CURRENTLY IN PROGRESS -- FROM A DEEP CONCERN FOR THE ELEGANCE OF ALGORITHMS TO VARYING DEGREES OF INTEREST IN SATISFYING INDIVIDUAL USERS, BUT HOW DOES ONE DISCOVER THE "BEST" METHOD FOR DESIGNING A USER INTERFACE? QUITE CONTRARY TO POPULAR OPINION, "ARMCHAIR" INTUITIVE DESIGN TECHNIQUES HAVE NOT PROVED TO BE A SUFFICIENT BASIS FOR EVEN THE MOST CONCERNED SYSTEM DESIGNERS TO USE. THE STUDY BEING REPORTED ON IS A CASE IN POINT, IT WAS THE INTUITIVE FEELING OF THE AUTHORS THAT INTERFACE FLEXIBILITY WOULD BE UNIFORMLY "GOOD" FOR ALL USERS, BUT THE DATA DID NOT SUPPORT THIS CONTENTION. (A, ABBR.)

COMMENTS:

THIS IS A SUMMARY OF AN EXPERIMENT PREVIOUSLY REPORTED BY WALTHER (1973). THE KEY RESULT IS THAT NOT ALL USERS BENEFIT FROM INTERFACE FLEXIBILITY AND THAT SUCH FLEXIBILITY CAN DEGRADE THE PERFORMANCE OF NOVICE USERS. THE READER INTERESTED IN A MORE DETAILED DESCUSSION OF THIS EXPERIMENT AND OF THE TYPES OF USERS THAT BENEFIT MOST FROM A FLEXIBLE INTERFACE SHOULD CONSULT THE ORIGINAL PAPER BY WALTHER.

INTERACTIVE GRAPHICAL DISPLAYS

AARD, J.E. SYSTEMS ENGINEERING PROBLEMS IN COMPUTER-DRIVEN CRT DISPLAYS FOR MAY-MACHINE COMMUNICATION. IEEE TRANSACTIONS ON SYSTEMS SCIENCE AND CYBERNETICS, 1967, SSC-3, 47-54.

DESCRIPTION:

COMPUTER-DRIVEN CATHODE-RAY TUBE (CRT) DISPLAYS ARE BECOMING AN IMPORTANT MEANS OF ON-LINE MAN-MACHINE COMMUNICATION, PARTICULARLY FOR GRAPHICAL INPUT/OUTPUT IN LABORATORY INVESTIGATIONS OF COMPUTER-AIDED DESIGN TECHNIQUES. THEIR OPERATION, HOWEVER, OFTEN REQUIRES SO MUCH OF THE COMPUTATIONAL RESOURCES OF THE ASSOCIATED COMPUTER THAT THEY ARE NOT YET CONSIDERED ECONOMIC OR PRACTICAL FOR GENERAL INDUSTRIAL USE. THIS PAPER DISCUSSES THE SYSTEMS ENGINEERING PROBLEMS IN DESIGNING AND USING DISPLAY SYSTEMS, WITH EMPHASIS ON THE HARDWARE-SOFTWARE TRADEOFFS. AS AN EXAMPLE, A DISPLAY SPECIFICALLY DEVELOPED FOR COMPUTER-AIDED DESIGN APPLICATIONS IS DESCRIBED WHICH HAS UNUSUAL SPECIAL-PURPOSE COMPUTING CAPABILITIES FOR DYNAMIC PICTURE MANIPULATIONS, INCLUDING ROTATION, SCALING, AND TRANSLATION OF 3-DIMENSIONAL IMAGES. IT IS CONCLUDED THAT THERE IS MUCH WORK AHEAD, AND THAT THE PROPER HARDWARE-SOFTWARE ORGANIZATION FOR THESE COMPLEXES OF COMPUTERS, COMMUNICATION LINKS, TERMINALS, AND MEN IS A FERTILE FIELD FOR THE SYSTEMS ENGINEER. (A) 8P, 10R.

COMMENTS:

THIS PAPER IS PRIMARILY CONCERNED WITH DESCRIBING A SPECIFIC DISPLAY CONSOLE. THIS CONSOLE WAS SPECIFICALLY DESIGNED TO REDUCE COMPUTER LOAD, IMPROVE DYNAMIC RESPONSE TIME, AND TO INCREASE THE AMOUNT AND FORM OF INFORMATION THAT CAN BE DISPLAYED. THESE FEATURES WERE ACCOMPLISHED BY DEVELOPING SPECIALIZED HARDWARE. AT THE TIME THIS PAPER WAS WRITTEN, TIME-SHARING SYSTEMS AND INTERACTIVE DISPLAYS WERE RELATIVELY NEW. AS A RESULT, MOST OF THE PROBLEM AREAS DEFINED IN THIS PAPER ARE NO LONGER OF CURRENT CONCERN. THIS PAPER MAY BE OF INTERST, HOWEVER, TO THOSE CONCERNED WITH THE DESIGN AND DEVELOPMENT OF INTERACTIVE DISPLAYS.

543 ERROR PREVENTION AND RECOVERY IN MAN-COMPUTER DIALOGUE
JASSERMAN, A.I. THE DESIGN OF 'IDIOT-PROOF' INTERACTIVE PROGRAMS. AFIPS
CONFERENCE PROCEEDINGS, 1973, 42, M34-M38.
DESCRIPTION:

THIS PAPER IS CONCERNED WITH ERROR-PREVENTION AND ERROR-RECOVERY MECHANISMS IN INTERACTIVE APPLICATION PROGRAMS. THE AUTHOR'S CONCEPT OF "IDIOT-PROOF" SOFTWARE IS CONCERNED WITH HANDLING ALL POSSIBLE USER INPUTS, EITHER CORRECTLY OR WITH EXPLICIT ERROR MESSAGES, AND SUCH OTHER PROBLEMS AS A BROKEN TRANSMISSION LINE, INADVERTENT TRANSMISSION, AND TRANSMISSION ERRORS. ALTHOUGH THE AUTHOR DISTINGUISHES BETWEEN "IDIOT-PROOF" (ERROR-RESISTANT) AND "USER-ORIENTED", MOST OF THE RULES OF THUMB WHICH HE PRESENTS SHOULD IMPROVE BOTH OF THESE ASPECTS OF THE SYSTEM. THE PAPER ALSO DISCUSSES SOME LANGUAGE FEATURES WHICH ARE DESIRABLE TO ALLOW DEVELOPMENT OF SUCH ERROR-RESISTANT SOFTWARE.

5P, 12R.

COMMENTS:

ALTHOUGH THIS IS NOT A HIGHLY DETAILED TREATMENT, THE DISCUSSION IS A FAIRLY GOOD ONE, AND THE FIVE PRINCIPLES ADVOCATED ARE APPROPRIATE. THE PAPER SHOULD BE READ BY THOSE INTERESTED IN INTERACTIVE SYSTEM DESIGN AND IN PROGRAMMING LANGUAGE DESIGN.

544 MAN-COMPUTER INTERFACE FOR LARGE, GENERAL PURPOSE INTERACTIVE SYSTEM WATSON, R.W. USER INTERFACE DESIGN ISSUES FOR A LARGE INTERACTIVE SYSTEM. AFIPS CONFERENCE PROCEEDINGS, 1976, 45, 357-364. DESCRIPTION:

USER INTERFACE DESIGN ISSUES ARE DISCUSSED FOR A LARGE INTERACTIVE SYSTEM. THE ASSUMPTIONS ABOUT THE USER ENVIRONMENT ARE EXPLICITLY DESCRIBED. ISSUES DISCUSSED INCLUDE COMMAND LANGUAGE SYNTAX, COMMAND RECOGNITION AND COMPLETION, SUBSYSTEM ORGANIZATION, USER EXTENSION CAPABILITIES, USER OPTIONS, AND VARIOUS FORMS OF PROMPTING, HELP AND FEEDBACK. THESE ISSUES ARE DISCUSSED WITHIN THE CONTEXT OF AN EXISTING SYSTEM, THE NLS SYSTEM.

8P, 14R.

COMMENTS:

THIS ARTICLE CONTAINS A USEFUL DISCUSSION OF SOME OF THE ISSUES INVOLVED IN THE DESIGN OF A COMMAND LANGUAGE (AND RELATED ASPECTS OF THE USER INTERFACE) FOR A LARGE, MULTI-APPLICATION INTERACTIVE SYSTEM. IT IS IMPORTANT TO RECOGNIZE THAT THIS DISCUSSION IS DIRECTED PRIMARILY AT THE DEFINITION OF GENERAL USER-INTERFACE PROPERTIES FOR A GENERAL-PURPOSE SYSTEM WHICH INCLUDES TEXT EDITING, INTERACTIVE PROGRAMMING, AND SEVERAL OTHER CURRENT APPLICATIONS AND WHICH MUST EXPAND TO ENCOMPASS PRESENTLY UNFORESEEN SUBSYSTEMS. WHILE MANY OF THE CONSIDERATIONS WHICH ARE RELEVANT HERE ARE ALSO IMPORTANT IN SPECIALIZED APPLICATION SYSTEMS, IT DOES NOT FOLLOW THAT THE KIND OF COMMAND LANGUAGE DEVELOPED HERE WOULD BE APPROPRIATE FOR SUCH SYSTEMS. FOR ITS PURPOSE, THOUGH, THIS APPROACH IS GOOD AND IS WELL DISCUSSED HERE.

545 INTERPERSONAL DIALOGUE

WEEKS, G.D., & CHAPANIS, A. COOPERATIVE VERSUS CONFLICTIVE PROBLEM SOLVING IN THREE TELECOMMUNICATION MODES. PERCEPTUAL AND MOTOR SKILLS, 1976, 42, 879-917. (NTIS NO. AD AD16020)
DESCRIPTION:

FORTY-EIGHT TWO-PERSON TEAMS COMMUNICATED THROUGH CHANNELS SIMULATING VARIOUS MODES OF TELECOMMUNICATION, TELETYPEWRITER, TELEPHONE, AND CLOSED-CIRCUIT TELEVISION, AND, AS A CONTROL, FACE-TO-FACE CONVERSATION. EACH TEAM WAS REQUIRED TO SOLVE ONE OF FOUR PROBLEMS. TWO COOPERATIVE PROBLEMS, A CLASS SCHEDULING AND A GEOGRAPHIC ORIENTATION PROBLEM, REQUIRED THE MUTUAL EXCHANGE OF FACTUAL INFORMATION TO REACH THE UNIQUE PROBLEM SOLUTION. TWO CONFLICTIVE PROBLEMS, AN ISSUE RANKING AND A BUDGET NEGOTIATION PROBLEM, WERE FORMULATED TO ENGENDER CONTENTION BETWEEN THE TWO TEAM MEMBERS.
PERFORMANCE WAS ASSESSED ON THREE CLASSES OF DEPENDENT MEASURES: TIME TO SOLUTION, BEHAVIORAL MEASURES OF ACTIVITY, AND MEASURES OF VERBAL PRODUCTIVITY. ADDITIONALLY, THE PROTOCOLS AND OUTCOMES OF THE CONFLICTIVE PROBLEM-SOLVING SESSIONS WERE EXAMINED TO ARRIVE AT A MEASURE OF THE DEGREE OF PERSUASION EXHIBITED BY THE TWO COMMUNICATORS. FOR BOTH KINDS OF PROBLEM SOLVING, THERE WAS A SHARP DICHOTOMY IN PERFORMANCE, ON ALL THREE CLASSES OF DEPENDENT VARIABLE, BETWEEN THE TELETYPEWRITER MODE AND THE OTHER THREE MODES ALL OF WHICH HAD A VOICE CHANNEL. SOLUTIONS TO ALL PROBLEMS IN THE VOICE MODES WERE MUCH FASTER BUT AT THE SAME TIME FAR MORE VERBOSE THAN THOSE IN THE TELEYPEWRITER MODE. THE ADDITION OF A VISUAL CHANNEL TO A VOICE MODE DOES NOT APPRECIABLY DECREASE SOLUTION TIMES, NOR DOES IT MATTER WHETHER THE VISUAL CHANNEL IS "LIVE," THAT IS, FACE-TO-FACE, OR MEDIATED BY A CLOSED-CIRCUIT TELEVISION SYSTEM. FOR THE MOST PART, MODE EFFECTS WERE ROBUST AND HELD FOR ALL PROBLEMS. THE CHARACTERISTICS OF THE SEVERAL MODES OF COMMUNICATIN WERE LARGELY INDEPENDENT OF THE KIND OF TASK ASSIGNED TO THE TEAMS OF SUBJECTS. (A) 29P, 39R.

COMMENTS:

THIS IS ONE OF A SERIES OF EXPERIMENTS CONDUCTED BY CHAPANIS AND HIS COLLEAGUES AT JOHNS HOPKINS UNIVERSITY ON INTERPERSONAL COMMUNICATION. A COMMON FEATURE OF THESE STUDIES IS THAT PROBLEM-SOLVING BEHAVIOR IS CLASSIFIED INTO A NUMBER OF CATEGORIES AND A LARGE NUMBER OF DEPENDENT VARIABLES ARE MEASURED. IN THE PRESENT EXPERIMENT, STATISTICAL ANALYSES EXAMINED 283 POTENTIAL EFFECTS AND 70 WERE JUDGED TO BE SIGNIFICANT. IN PREVIOUS STUDIES IN THIS SERIES, SEVERAL PROBLEMS WERE USED BUT SIGNIFICANT EFFECTS DUE TO THE PROBLEM FACTOR WERE LARGELY IGNORED. IN THE PRESENT STUDY, HOWEVER, SOME ATTENTION IS GIVEN TO PROBLEM EFFECTS AND THE INTERACTION BETWEEN PROBLEM AND MODE OF COMMUNICATION, WHICH PRIMARILY AFFECTS MESSAGE LENGTH. A MORE CAREFUL ANALYSIS OF THE PROBLEM USED, HOWEVER, WOULD APPEAR TO CONTRIBUTE SIGNIFICANTLY TO THIS RESEARCH.

546 INTERPERSONAL DIALOGUE

WEEKS, G.D., KELLY, M.J., & CHAPANIS, A. STUDIES IN INTERACTIVE COMMUNICATION:
V. COOPERATIVE PROBLEM SOLVING BY SKILLED AND UNSKILLED TYPISTS IN A
TELETYPEWRITER MODE. JOURNAL OF APPLIED PSYCHOLOGY, 1974, 59, 665-674.
DESCRIPTION:

TWO-PERSON TEAMS OF SKILLED AND OF UNSKILLED TYPISTS (N=16) COOPERATED TO SOLVE CREDIBLE, REAL-WORLD PROBLEMS BY COMMUNICATING THROUGH INTERCONNECTED TYPEWRITERS OR, AS A CONTROL, BY CONVERSING FACE-TO-FACE. PERFORMANCE WAS ASSESSED BY (A) THE TIME TAKEN TO SOLVE A PROBLEM, (B) MEASURES OF BEHAVIORAL ACTIVITY, AND (C) SEVERAL MEASURES OF VERBAL OUTPUT. ALL THREE CRITERIA SHOWED LARGE DIFFERENCES BETWEEN FACE-TO-FACE COMVERSATION AND COMMUNICATION VIA TYPEWRITER. THERE WERE, HOWEVER, NO DIFFERENCES BETWEEN THE TWO GROUPS OF TYPISTS ON ANY CRITERIA EVEN WHEN THEY COMMUNICATED BY TYPEWRITER, IN PART BECAUSE ONE-THIRD OR LESS OF THE TOTAL TIME WAS SPENT TYPING, AND IN PART BECAUSE SUBJECTS COMPOSED THEIR OWN MESSAGES. THESE FINDINGS HAVE IMPLICATIONS FOR THE USE OF KEYBOARD TERMINALS IN TELECOMMUNICATIONS AND INTERACTIVE COMPUTER SYSTEMS. (A) 10P, 13R.

COMMENTS:

IN GENERAL, THIS EXPERIMENT WAS CAREFULLY CONTROLLED AND WELL SUITED FOR EXAMINING PRINCIPLES OF HUMAN COMMUNICATION. THE FINDING THAT TYPING SKILL DOES NOT SIGNIFICANTLY AFFECT PERFORMANCE HAS USEFUL IMPLICATIONS FOR MANCOMPUTER INTERACTION. THE METHOD OF REPORTING AND ANALYZING RESULTS, HOWEVER, OBSCURES POTENTIALLY RELEVANT INFORMATION. THIS STUDY USED FOUR SEPARATE PROBLEMS. THESE PROBLEMS APPEAR TO DIFFER WITH RESPECT TO THE INFORMATION THAT IS NECESSARY TO ACHIEVE A SOLUTION AND WITH RESPECT TO THE PROBLEM-SOLVING STRATEGIES THAT WOULD BE MOST EFFECTIVE. IT MAY BE POSSIBLE THAT THERE ARE SIGNIFICANT INTERACTIONS BETWEEN THE TYPE OF PROBLEM AND TYPING SKILL OR COMMUNICATION MODE. SUCH INTERACTIONS WOULD INDICATE WHETHER THE OPTIMAL PROPERTIES OF AN INTERPERSONAL OR MAN-COMPUTER DIALOGUE DIFFER AS A FUNCTION OF THE TASK TO BE PERFORMED. THE PRESENT STUDY, HOWEVER, DOES NOT TREAT PROBLEM-TYPE AS AN INDEPENDENT VARIABLE.

547 ARCHITECTURAL DESIGN AIDS FOR NOVICE USERS
WEINZAPFEL, G., & NEGROPONTE, N. ARCHITECTURE-BY-YOURSELF: AN EXPERIMENT WITH
COMPUTER GRAPHICS FOR HOUSE DESIGN. CAMBRIDGE, MASSACHUSETTS: MASSACHUSETTS
INSTITUTE OF TECHNOLOGY, ARCHITECTURE MACHINE GROUP, UNDATED.
DESCRIPTION:

THIS PAPER DESCRIBES AN EXPERIMENT IN COMPUTER-AIDED ARCHITECTURAL DESIGN THAT UTILIZES TOUCH SENSITIVE GRAPHICAL DISPLAYS. THESE AIDS ARE INTENDED TO BE USED BY UNPRACTICED DESIGNERS WHO, UNLIKE TRAINED DESIGNERS, ARE NOT TRAINED AND PRACTICED IN THE REQUIRED SKILLS. SUCH DESIGNERS, THEREFORE, REQUIRE GREATER ASSISTANCE IN VISUALIZING THEIR GOALS AND IN FINDING POTENTIAL SOLUTIONS FOR THESE GOALS AS WELL AS BEING DIRECTED IN WHAT STEPS TO PURSUE NEXT. IN ADDITION, THIS RESEARCH IS ALSO CONCERNED WITH GRAPHICAL INPUT TECHNIQUES, DISPLAY CAPABILITIES AND DESIGN STRATEGY SYSTEMS.

COMMENTS:

THIS PAPER CONTAINS A NON-TECHNICAL DESCRIPTION OF A COMPUTER GRAPHICS SYSTEM FOR ARCHITECTURAL DESIGN. AN INTERESTING ASPECT OF THIS SYSTEM IS THAT IT IS INTENDED TO BE USED BY NOVICE, RATHER THAN EXPERIENCED, DESIGNERS. A POSSIBLE ADVANTAGE OF DESIGNING A SYSTEM FOR USE BY NOVICE USERS IS THAT SUCH USERS WILL MAKE FAIRLY EXTENSIVE AND EXTREME DEMANDS OF THE SYSTEM AND THAT CONSIDERING THESE DEMANDS WILL LEAD TO SIGNIFICANT IMPROVEMENTS IN THE DESIGN OF INTERACTIVE SYSTEMS. THE GOAL OF SUCH A SYSTEM IS, THEREFORE, NOT ONLY TO ALLOW INEXPERIENCED USERS TO DO ARCHITECTURAL DESIGN, BUT ALSO TO IDENTIFY AREAS WHERE ADDITIONAL RESEARCH AND DEVELOPMENT COULD LEAD TO IMPROVING MAN-MACHINE INTERACTION IN GENERAL. THIS PAPER CONTAINS SEVERAL IDEAS WHICH ARE RELEVANT TO THE AREAS OF ARCHITECTURAL DESIGN, INTERACTIVE GRAPHICS, AND MAN-COMPUTER INTERACTION.

548 AUTOMATIC TAKEOVER AND OTHER DECISION AIDING MECHANISMS
WELTMAN, G., STEEB, R., FREEDY, A., SMITH, M., & WEISBROD, R. EXPERIMENTAL
STUDY OF MAN/MACHINE INTERACTION IN ADAPTIVE COMPUTER AIDED CONTROL (TECHNICAL
REPORT 73-10). WOODLAND HILLS, CALIFORNIA: PERCEPTRONICS, INC., NOVEMBER 1973.
(NTIS NO. AD 775879)
DESCRIPTION:

THE AUTONOMOUS CONTROL SUBSYSTEM (ACS) WAS USED IN AN EXPERIMENTAL INVESTIGATION OF MAN-MACHINE INTERACTION IN A GENERALIZED CONTROL TASK SIMULATION. THE ACS IS AN ADAPTIVE MAXIMUM LIKELIHOOD DECISION MAKER THAT IS ABLE TO SELECT CONTROL ACTIONS ON THE BASIS OF PRIOR OBSERVATION AND EXPERIENCE. AUTOMATIC ALLOCATION OF CONTROL TO THE ACS WAS SIGNIFICANTLY BETTER THAN VOLUNTARY TURNOVER, SUBJECTS PERFORMED BETTER AFTER EXPOSURE TO THE PRINCIPLES OF MACHINE LEARNING, AND PERFORMANCE SCORES WERE NEGATIVELY CORRELATED WITH THE COST OF ERRORS. SIGNIFICANT CORRELATIONS WERE OBSERVED BETWEEN PERFORMANCE SCORES AND SOME PERSONAL CHARACTERISTICS. 61P., 16R.

COMMENTS:

THIS IS AN INTERESTING STUDY OF THE USE OF ADAPTIVE AIDING IN A DISCRETE CONTROL TASK. A PARTICULARLY INTERESTING ASPECT OF THIS WORK IS ITS INNOVATIVE APPROACH TO AUTOMATIC TAKEOVER OF THE DECISION TASK BY THE COMPUTER SYSTEM BASED ON CONFIDENCE CALCULATIONS BUILT INTO ITS DECISION MODEL. THERE ARE MANY KINDS OF DECISION TASKS IN WHICH AUTOMATIC TAKEOVER AT AN APPROPRIATE POINT MAY RESULT IN IMPROVED PERFORMANCE, BUT USERS ARE OFTEN VERY RESISTANT TO WORKING WITH SUCH SYSTEMS. HERE THE AUTOMATIC TAKEOVER IS BASED ON CRITERIA WHICH CAN BE ADJUSTED BY THE USER, AN APPROACH WHICH IS LIKELY TO LEAD TO MUCH GREATER USER ACCEPTANCE. THIS STUDY DOES NOT ADDRESS THE USER ACCEPTANCE QUESTION, BUT DOES DEMONSTRATE THAT THE AUTOMATIC TAKEOVER, DONE IN THIS FASHION, RESULTS IN BETTER PERFORMANCE THAN A VOLUNTARY TURNOVER OF CONTROL BY THE USER. GENERALIZATION TO OTHER DECISION TASKS THAN THE SOMEWHAT ARTIFICIAL TASK USED IN THE STUDY IS UNMARRANTED WITHOUT FURTHER RESEARCH, BUT THE RESULT SHOULD BE SUGGESTIVE FOR A WIDE RANGE OF DECISION TASKS. THE REPORTED CORRELATIONS OF USER PERFORMANCE WITH AGE, ATTITUDE MEASURES, MECHANICAL APTITUDE, AND SUBJECT TRAINING IN THE PRINCIPLES OF MACHINE LEARNING ARE ALSO USEFUL. THE PAPER SHOULD BE OF INTEREST TO THOSE CONCERNED WITH AUTOMATED DECISION AIDS, HUMAN DISCRETE CONTROL SYSTEMS.

549 DISPLAY CODING TECHNIQUES
WHEATLEY, E. AN EXPERIMENT ON CODING PREFERENCES FOR DISPLAY SYMBOLS.
ERGONOMICS, 1977, 20, 543-552.
DESCRIPTION:

IN AN EXPERIMENT TO INVESTIGATE USE OF MULTIDIMENSIONAL CODING FOR DISPLAYS, SUBJECTS WERE SHOWN A SERIES OF PAIRS OF SMALL HEXAGONAL FIGURES, AND WERE ASKED TO CHOOSE THE MORE "HOSTILE" OF EACH PAIR. THEY WERE INSTRUCTED THAT FOR EACH SYMBOL HOSTILITY WAS SHOWN BY SPIKINESS (SHAPE), HIGHER NUMERALS, AND INCREASED REDNESS. FOR MOST OF THE PAIRS, THERE WERE NO CORRECT ANSWERS, SINCE ACCORDING TO A STRAIGHT-FORWARD ADDITIVE MODEL, THE SYMBOLS WITHIN EACH PAIR HAD EQUAL VALUES OF HOSTILITY. SUBJECTS WERE UNAWARE OF THIS, AND IT IS POSTULATED THAT THEY CHOSE ON THE BASIS OF THE STIMULUS FEATURE THAT SEEMED MOST SALIENT TO THEM. RESULTS OF THE FXPERIMENT INDICATED THAT SPIKINESS AND COLOR HAD A MUCH GREATER SALIENCY THAN THE NUMERALS.

SUBJECTS ABILITY TO COMBINE EVIDENCE FROM DIFFERENTLY CODED SOURCES WAS INVESTIGATED WITH OTHER PAIRS OF SYMBOLS FOR WHICH THERE WERE RIGHT AND WRONG ANSWERS. ANALYSIS OF ERRORS CONFIRMED THE SALIENCY FINDINGS, AND SUGGESTED THAT THREE DIFFERENT "DIMENSIONS" MAY BE THE MOST THAT SHOULD BE USED FOR CODING. (A)

10P, 16R.

THERE ARE SEVERAL POTENTIAL PROBLEMS WITH THIS STUDY. ALTHOUGH THE AUTHOR MENTIONS SOME OF THESE, SHE DOES NOT CONSIDER THEIR POSSIBLE EFFECTS ON THE REPORTED RESULTS. FOR EXAMPLE, THE ORDERING OF STIMULI ALONG THE "SHAPE" AND "NUMERAL" DIMENSIONS WAS ON THE BASIS OF NUMERICAL ORDER AND SUBJECTS CAN EASILY PERCEIVE AND ACCURATELY CLASSIFY STIMULI ALONG THESE DIMENSIONS. THE "COLOR" DIMENSION, HOWEVER, WAS BASED ON THE SPECTRAL ORDER OF COLORS AND, SINCE SOME SUBJECTS ADMITTED UNCERTAINTY AS TO THIS ORDER, CLASSIFICATION MAY BE LESS ACCURATE THAN WITH THE OTHER DIMENSIONS. SUBJECTS' CLASSIFICATIONS, THEREFORE, MAY TEND TO BE QUALITATIVE AND SUBJECTIVE AND HAVE LITTLE CORRESPONDENCE WITH THE QUANTITATIVE, OBJECTIVE RULE USED TO CONSTRUCT STIMULUS PAIRS. A RELATED PROBLEM IS THE FACT THAT TWO PHYSICALLY DISTINCT DIMENSIONS MAY BE PERCEIVED AS A SINGLE PSYCHOLOGICAL DIMENSION. THAT IS, RESPONSES ARE BASED ON THE INTERACTIONS OF DIMENSIONS RATHER THAN ON INDIVIDUAL DIMENSIONS. AN ADDITIONAL PROBLEM INVOLVES THE FACT THAT THE ABILITY TO IDENTIFY ACHROMATIC FEATURES CAN BE DEGRADED BY THE ADDITION OF COLOR. THIS WOULD BE ESPECIALLY PRONOUNCED IF DARK COLORS (E.G., BLUE) WERE SUPERIMPOSED ON BLACK SHAPES AND NUMBERS, AS IS PRESUMBBLY THE CASE IN THIS EXPERIMENT. IN GENERAL, A VARIETY OF POTENTIALLY UNCONTROLLED EFFECTS PREVENT AN UNAMBIGUOUS INTERPRETATION OF THE RESULTS OF THIS EXPERIMENT. IN SOME SITUATIONS, HOWEVER, IN WHICH STIMULI CAN BE ASSIGNED AN UNAMBIGUOUS VALUE ALONG SOME DIMENSON AND IN WHICH SUBJECTS ARE AWARE OF THE ORDERINGS OF VALUES ALONG THE DIMENSIONS THAT COMPRISE THE STIMULUS, THE EXPERIMENTAL PROCEDURE DESCRIBED HERE WOULD BE USEFUL IN DETERMINING THE SALIENCY OF THESE DIMENSIONS.

DISPLAY SCREEN SIZE AND RESOLUTION

WHITHAM, G.E. THE DETERMINATION OF DISPLAY SCREEN SIZE AND RESOLUTION BASED
ON PERCEPTUAL AND INFORMATION LIMITATIONS. INFORMATION DISPLAY, JULY/AUGUST
1965, 2(4), 15-19.
DESCRIPTION:

THE MATERIAL PRESENTED IN THIS PAPER OFFERS USEFUL, HANDBOOK TYPE INFORMATION TO ENABLE THE DISPLAY SYSTEM DESIGNER TO DETERMINE RAPIDLY THE LIMITING VALUES OF BASIC DISPLAY PARAMETERS SO THAT HE CAN DEVOTE HIS ATTENTION TO THOSE UNIQUE DETAILS INHERENT TO THE DESIGN OF A SPECIFIC SYSTEM.

BY CONSIDERING DISPLAYS IN TERMS OF THEIR MINIMUM RESOLVABLE ELEMENTS, A SERIES OF DESIGN CHARTS HAVE BEEN DEVELOPED FROM WHICH LIMITING DESIGN RANGE VALUES CAN BE OBTAINED FOR DISPLAY ELEMENT SIZE, OVERALL SIZE, SYMBOL SIZE AND MAXIMUM SYMBOL QUANTITY FOR ORDERED OR RANDOM SYMBOLS. WITHIN THESE LIMITS MORE EXACT PARAMETRIC VALUES CAN BE SPECIFIED IN TERMS OF THE EFFECT ON THEM OF OTHER SYSTEM PARAMETERS. IN THIS MANNER THE FEASIBILITY OF A DISPLAY CONFIGURATION CAN BE VERIFIED IN TERMS OF FUNDAMENTAL LIMITATIONS, AND INCONSISTENT REQUIREMENTS CAN BE MODIFIED IN THE CONCEPTUAL PHASE. (A)

COMMENTS:

THIS IS A GOOD SOURCE FOR THE DISPLAY DESIGNER OR PURCHASER WHO NEEDS A QUICK AND EASY METHOD FOR DETERMINING OPTIMAL VALUES OF MAJOR DISPLAY PARAMETERS. THE PHYSICAL CHARACTERISTICS OF BOTH HUMAN VISION AND DISPLAYS ARE WELL DEFINED AND IT IS A RATHER SIMPLE MATTER TO DETERMINE OPTIMAL VALUES FOR DISPLAY PARAMETERS. HOWEVER, OPTIMAL IN A PHYSICAL SENSE DOES NOT NECESSARILY IMPLY OPTIMALITY AT THE INTERFACE BETWEEN OPERATOR AND DISPLAY. THE INFORMATION REQUIREMENTS OF A GIVEN TASK, THE PSYCHOPHYSICS OF HUMAN PERCEPTION, AND OTHER FACTORS, MAY INFLUENCE THE DETERMINATION OF OPTIMAL PARAMETER VALUES. ALTHOUGH THE AUTHOR ALLUDES TO THIS BRIEFLY IN HIS CONCLUSIONS, THESE FACTORS ARE NOT CONSIDERED IN THE BODY OF THIS PAPER. THE PARAMETER VALUES PRERSENTED IN THIS PAPER, THEREFORE, SHOULD NOT BE CONSIDERED ABSOLUTE VALUES THAT APPLY TO ALL SITUATIONS.

551 BEHAVIORAL MISCONCEPTIONS WHICH MAY LEAD TO INFERIOR SYSTEMS WILCOX, R.H. BEHAVIORAL MISCONCEPTIONS FACING THE SOFTWARE ENGINEER. IN J.T. TOU (ED.), SOFTWARE ENGINEERING: COINS III (PROCEEDINGS OF THE THIRD SYMPOSIUM ON COMPUTER AND INFORMATION SCIENCES HELD IN MIAMI BEACH, FLORIDA, DECEMBER 1969) (VOL. 2). NEW YORK: ACADEMIC PRESS, 1971, 285-287. DESCRIPTION:

THIS ARTICLE BRIEFLY DISCUSSES A FEW MISCONCEPTIONS OF USER BEHAVIOR WHICH MAY LEAD AN INFORMATION SYSTEM DESIGNER TO DELIVER AN INAPPROPRIATELY DESIGNED SYSTEM.

3P, OR.

COMMENTS:

THIS ARTICLE IS CONCERNED WITH INFORMATION SYSTEMS. THE MISCONCEPTIONS CONSIDERED ARE THAT THE USER ACTUALLY WANTS A NEW INFORMATION SYSTEM, THAT THE DESIGNER CAN RELY ON HIS INTROSPECTIONS AND INTUITION, THAT THE PRIMARY USERS CAN BE IDENTIFIED, THE ABSENCE OF SECONDARY (BUT DESIRABLE) SYSTEM FUNCTIONS, AND THAT THE INITIAL DESIGN WILL BE ADEQUATE. THE AUTHOR IS QUITE CORRECT IN NOTING THAT USER ACCEPTANCE IS THE ULTIMATE TEST OF SYSTEM SUCCESS AND USER ACCEPTANCE IS STRONGLY RELATED TO ADEQUATE USER REUIREMENTS DEFINITION. ALTHOUGH THE AUTHOR CONCISELY POINTS OUT PROBLEMS, HE DOES NOT ATTEMPT TO PROVIDE SOLUTIONS.

552 COMPUTER-AIDED BIBLIOGRAPHIC SEARCH

WILDE, D.U. COMPUTER-AIDED STRATEGY DESIGN USING ADAPTIVE AND ASSOCIATIVE TECHNIQUES. PROCEEDINGS OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE, 1968, 5, 175-178.

DESCRIPTION:

THE PURPOSE OF COMPUTER-AIDED STRATEGY DESIGN IS TO HELP THE STRATEGY DESIGNER MAKE MORE EFFICIENT USE OF HIS DATA BASE. IN THE PAST WHEN THE RESULTS OF AN INFORMATION RETRIEVAL RUN WERE UNSATISFACTORY, THE STRATEGY DESIGNER (SD) HAD NO ORDERLY PROCESS TO FOLLOW IN IMPROVING HIS NEXT STRATEGY ATTEMPT. THIS PAPER PRESENTS A COMPUTER-AIDED STRATEGY DESIGN PROCEDURE WHICH WILL GUIDE SD TO HIS GOAL OF MORE RELEVANT DOCUMENTS IN LESS TIME. THE PROCEDURE IS A UNIQUE SYNTHESIS OF ADAPTIVE AND ASSOCIATIVE TECHNIQUES WHICH PERMITS SD AND COMPUTER TO WORK AS A TEAM. THE SYSTEM IS ESPECIALLY SUITED FOR A TIME-SHARED COMPUTER. (A)

4P, 5R.

THIS PAPER IS CONCERNED WITH DEVELOPING AN EFFICIENT SEARCH PROCEDURE FOR LARGE DATA BASES. THE PRINCIPAL POINT IS THAT INFORMATION GAINED FROM A PREVIOUS SEARCH, EVEN THOUGH THAT SEARCH WAS UNSUCCESSFUL, CAN BE USED TO FORMULATE SUCCEEDING SEARCHES. THE CONCEPT OF AN ITERATIVE SEARCH PROCEDURE APPEARS REASONABLE; THE VALUE OF THE COMPUTERIZED AID DESCRIBED IN THIS PAPER, HOWEVER, IS NOT CONCLUSIVELY TESTED. A SIMILAR AND MORE EASILY IMPLEMENTED AID FOR BIBLIOGRAPHIC SEARCH IS DESCRIBED IN D.U. WILDE (1969).

553 COMPUTER-AIDED BIBLIOGRAPHIC SEARCH

JILDE, Q.U. ITERATIVE STRATEGY DESIGN. AMERICAN DOCUMENTATION, 1969, 20,
90-91.

DESCRIPT (ON:

THIS PAPER DESCRIBES A RETRIEVAL PROCEDURE AND A STRATEGY DESIGN PHILOSOPHY WHICH PERMIT THE STRATEGY DESIGNER (SD) TO FOCUS IN ON HIS FINAL RESULTS. THE RETRIEVAL PROCEDURE ALLOWS SD TO ITERATIVELY PARTITION HIS DATA BASE INTO SUB-FILES AND TO QUICKLY EXAMINE SUB-FILE CONTENT. THE DESIGN PHILOSOPHY SUGGESTS THAT SD SHOULD FIRST USE A VERY GENERAL PARTITION AND THEN ITERATIVELY REPARTITION UNTIL HE IS SATISFIED WITH HIS RETRIEVAL RESULTS. (A)

IN THIS PAPER, "STRATEGY DESIGN" REFERS TO FORMULATING SEARCH STRATEGIES TO ACCESS LARGE BIBLIOGRAPHIC DATA BASES.

COMMENTS:

THIS PAPER IS CONCERNED WITH DESIGNING SEARCH STRATEGIES FOR LARGE BIBLIOGRAPHIC DATA FILES. SUCH A SEARCH INVOLVES TWO OPERATIONS -SELECTION OF THE PROPER INDEX TERMS AND SPECIFICATION OF THE APPROPRIATE LOGICAL CONNECTIVES. THE STRATEGY PROPOSED IN THIS PAPER INVOLVES FIRST FOCUSING ON THE SELECTION OF THE PROPER INDEX TERMS AND, WHEN SATISFIED WITH THE RESULTS, SELECTING THE APPROPRIATE LOGICAL RELATIONS. PARTITIONING THE SEARCH TASK INTO TWO SIMPLER SEARCH TASKS SHOULD IMPROVE PERFORMANCE. IN ADDITION, THE SEARCH PROCEDURE IS MORE ECONOMICAL SINCE SUCCESSIVE SEARCHES ARE APPLIED TO PROCESSIVELY SMALLER SUBSETS OF THE ENTIRE DATA BASE. THIS PAPER WOULD BE RELEVANT TO THOSE INTERESTED IN BIBLIOGRAPHIC SEARCH PROCEDURES AND SHOULD ALSO BE OF INTEREST TO ANYONE CONCERNED WITH ACCESSING LARGE, IMDEXED DATA BASES.

554 TOUCH-TONE TELEPHONE WITH SYNTHESIZED SPEECH WILDE, J.F., & SIEGEL, B. MAN-MACHINE CONSIDERATIONS IN TELEPHONE/COMPUTER VOICE-ANSWER-BACK APPLICATIONS. AN EXAMPLE: REGIONAL BLOOD INVENTORY MANAGEMENT. PROCEEDINGS OF THE HUMAN FACTORS SOCIETY ANNUAL MEETING, SAN FRANCISCO, 1970 (REPRINTED BY RIVERSIDE RESEARCH INSTITUTE, NEW YORK, NY). DESCRIPTION:

DURING SYSTEM ENGINEERING EFFORTS THE ATTRACTIVE ATTRIBUTES OF THE TOUCH-TONE AND CARD-DIALER TELEPHONE IN COMBINATION WITH A COMPUTER VOICE ANSWER-BACK SUBSYSTEM SHOULD NOT BE ALLOWED TO OVERSHADOW THE LIMITATIONS OF SUCH A DATA LINK. DESPITE ITS SIMPLICITY, ACCURACY, AVAILABILITY AND LOW COST, IN SOME SYSTEM APPLICATIONS LENGTHY INPUTS AND/OR HIGH INPUT RATES MAY FRUSTRATE THE CALLER BY REQUIRING HIM TO WAIT FOR EQUIPMENT RESPONSES, REPEAT REJECTED INPUTS AND CATCH UP TO THE TEMPORAL SEQUENCE REQUIRED BY THE SYSTEM. FURTHERMORE, SUCH ACTIVITIES CONSUME ADDITIONAL MAN HOURS. AN EXEMPLARY SYSTEM ANALYSIS IS PRESENTED WHICH ASSUMES THE APPLICABILITY OF A TELEPHONE/COMPUTER VOICE-ANSWER-BACK DATA LINK TO A HYPOTHETICAL REGIONAL BLOOD INVENTORY MANAGEMENT SYSTEM. EXPECTED DELAY TIMES AND TOTAL MAN TIME ON THE DATA LINK ARE DETERMINED ON THE BASIS OF REPRESENTATIVE WORKLOAD DATA FROM HOSPITAL BLOOD BANKS IN THE GREATER NEW YORK AREA, TIME LINE DATA, VARIATIONS IN SYSTEM CONFIGURATION AND QUEUING ANALYSIS. (A) 23P, 13R.

COMMENTS:

THE AUTHORS HAVE PERFORMED A TIMELINE ANALYSIS OF THE DATA-LINK ACTIVITIES WHICH MIGHT BE EXPECTED IF TOUCH-TONE DATA-ENTRY AND VOICE-ANSWER-BACK FACILITIES WERE USED TO PROVIDE ACCESS BY 2D HOSPITALS TO A REGIDNAL BLOOD INVENTORY MANAGEMENT INFORMATION SYSTEM. THEY CONCLUDE THAT DATA SET SATURATION AND RESULTING QUEUING PROBLEMS MIGHT CAUSE UNACCEPTABLE DELAYS. ALTHOUGH TOST OF THE RELEVANT ISSUES ARE TOUCHED UPON, THE EMPHASIS SEEMS INAPPROPRIATE. THE TIME DELAYS AND QUEUING PROBLEMS CAN BE ELIMINATED BY THE SIMPLE EXPEDIENT OF BUYING MORE DATA SETS. WHAT CANNOT BE ELIMINATED ARE THE BASIC FUNCTIONAL DEFICIENCIES OF THE TSLEPHONE AS A COMPUTER TERMINAL. WHILE IT MAY BE APPROPRIATE AS AN OCCASIONAL TERMINAL FOR CERTAIN SIMPLE TRANSACTIONS, IT IS ALMOST CERTAINLY UNACCEPTABLE FOR HEAVY USE BY A SINGLE OPERATOR. YET THE TRANSACTION FREQUENCY CALCULATIONS FOR THIS SYSTEM WOULD INDICATE THAT A LARGE HOSPITAL MIGHT REQUIRE A FULL-TIME TOUCH-TONE TELEPHONE OPERATOR. CERTAINLY THE FUNCTIONAL DEFICIENCIES OF THE DEVICE, WHICH THE AUTHORS MENTION WITHOUT EMPHASIS, WOULD CAUSE IT TO BE ABANDONED ON MUCH MORE BASIC GROUNDS THAN AN INADEQUATE NUMBER OF DATA SETS AT THE HOST COMPUTER.

HUMAN FACTORS METHODS APPLIED TO INTERACTIVE PLANNING
HILLMORTH, N.E. HUMAN FACTORS EXPERIMENTATION IN INTERACTIVE PLANNING. IN H.
SACKMAN & R.L. CITRENBAUM (EDS.), ONLINE PLANNING: TOWARDS CREATIVE PROBLEM
SOLVING. ENGLEWOOD CLIFFS, NEW JERSEY: PRENTICE-HALL, 1972, 281-313.
DESCRIPTION:

ALTHOUGH THERE ARE HUMAN ENGINEERING DESIGN CRITERIA FOR EQUIPMENT, THESE ARE POORLY DEFINED FOR INFORMATION-PROCESSING SYSTEMS. FOR EASE AND EFFICIENCY OF USE AND MAINTENANCE, INFORMATION AND ITS CONTROLS AND DISPLAYS SHOULD BE READILY ACCESSIBLE, FUNCTIONALLY GROUPED, EASILY DISCRIMINABLE, PROTECTED FROM DESTRUCTION OR DISCLOSURE, RELIABLE, AND COMPATIBLE WITH THE TASKS TO BE PERFORMED. A PLANNING LANGUAGE SHOULD BE SIMPLE AND EASY TO USE YET POWERFUL ENOUGH TO FORMULATE, ANALYZE AND EVALUATE PLANS.

THE COMPUTER IS BEST AT PROCESSING OF VOLUMINOUS AND VARIEGATED DATA

THE COMPUTER IS BEST AT PROCESSING OF VOLUMINOUS AND VARIEGATED DATA VIA EXTENSIVE, BUT WELL-FORMULATED ALGORITHMS. THE HUMAN IS RELATIVELY SLOW, INACCURATE, AND UNRELIABLE IN SUCH TASKS, BUT RELATIVELY SUPERIOR AT DETECTING RELATIONSHIPS, RECOGNIZING PATTERNS, AND PERFORMING ILL-DEFINED TASKS WITH PARTIAL, INACCURATE DATA. ALTHOUGH RESEARCH INTO ASSOCIATIVE PROCESSES, HEURISTICS, AND SEMANTIC ANALYSIS IS PROGRESSING, AT PRESENT THE INFORMATION PROCESSING SYSTEM SHOULD ONLY AID, NOT REPLACE, HUMANS IN INTERPRETIVE PROBLEM-SOLVING TASKS.

TO PERFORM CREDIBLE EXPERIMENTS IN PLANNING, EXPERIENCED EXPERTS ARE DESIRABLE. DESPITE INDUSTRY CLAIMS TO THE CONTRARY, EXTEMSIVE TRAINING IS REQUIRED TO USE INFORMATION-PROCESSING SYSTEMS EFFICIENTLY AND EFFECTIVELY. THE UNAVAILABILITY OF EXPERT PLANNERS WILL PRESENT SOME SEVERE RESTRICTIONS ON EXPERIMENTAL DESIGNS AND PROBLEMS, PARTIALLY OFFSET BY EXPERIMENTS IN USING THE SYSTEM IN TRAINING NEW PLANNERS.

EXPERIMENTS IN USING THE SYSTEM IN TRAINING NEW PLANNERS.

PLANNING EXPERIMENTS WILL BE CONCERNED BOTH WITH COMPARATIVE SYSTEM
PERFORMANCE AND COMPARISONS OF INDIVIDUAL PLANNING TECHNIQUES. COVERING
THE RANGE OF PLANNING, MEASURING PERFORMANCE, AND DEVELOPING DATA RECORDING
AND REDUCTION TOOLS ARE OF KEY CONCERN IN EXPERIMENTING WITH ONLINE
PLANNING SYSTEMS. (A)
33P. 10R.

#### COMMENTS:

THIS IS A VERY GENERAL PAPER THAT ATTEMPTS TO COVER THE AREAS OF HUMAN FACTORS AND EXPERIMENTAL DESIGN AS THEY RELATE TO INTERACTIVE PLANNING SYSTEMS. ALTHOUGH THIS PAPER MAY PROVIDE AN ADEQUATE INTRODUCTION TO THE NATURE OF THESE AREAS FOR ANYONE WHO IS TOTALLY UNFAMILIAR WITH EITHER HUMAN FACTORS OR EXPERIMENTAL DESIGN, IT CONTAINS VERY LITTLE USEFUL INFORMATION FOR THOSE WHO ARE FAMILIAR WITH THESE AREAS.

556 TOUCH-TONE TELEPHONE WITH SYNTHESIZED SPEECH
WITTEN, 1.H., & MADAMS, P.H.C. THE TELEPHONE ENQUIRY SERVICE: A MAN-MACHINE
SYSTEM USING SYNTHETIC SPEECH. INTERNATIONAL JOURNAL OF MAN-MACHINE STUDIES,
1977, 9, 449-464.
DESCRIPTION:

THE TELEPHONE ENQUIRY SERVICE IS A COMPUTER SYSTEM WHICH ALLOWS INTERACTIVE INFORMATION RETRIEVAL FROM AN ORDINARY TOUCH-TONE TELEPHONE. FOR INPUT, THE CALLER EMPLOYS THE TOUCH-TONE KEYPAD, AND THE COMPUTER REPLIES WITH A SYNTHETIC VOICE RESPONSE. THE SERVICE HAS BEEN IN FAIRLY CONTINUOUS OPERATION FOR AROUND ONE YEAR, USING A SMALL TIME-SHARED COMPUTER IN CONJUNCTION WITH AN INTERNAL 200-LINE TELEPHONE EXCHANGE, AND HAS BEEN WIDELY USED BY PEOPLE WITH NO SPECIAL INTEREST IN SYNTHETIC SPEECH.

AN UNUSUAL FEATURE OF THE SYSTEM IS THAT THE SPEECH IS GENERATED BY RULE FROM A PHONETIC REPRESENTATION. A SATELLITE COMPUTER, ACTING AS A PERIPHERAL TO THE MAIN MACHINE, PERFORMS THIS TASK IN REAL TIME, AND CONTROLS THE PARAMETERS OF AN ANALOGUE SPEECH SYNTHESIZER. THIS CONSTITUTE:

FROM A PHONETIC REPRESENTATION. A SATELLITE COMPUTER, ACTING AS A PERIPHERAL TO THE MAIN MACHINE, PERFORMS THIS TASK IN REAL TIME, AND CONTROLS THE PARAMETERS OF AN ANALOGUE SPEECH SYNTHESIZER. THIS CONSTITUTES AN EXTREMELY ECONOMICAL AND FLEXIBLE METHOD OF SPEECH STORAGE, WHOSE ONLY REAL DISADVANTAGE IS THE LOW QUALITY OF ARTICULATION OF THE OUTPUT. A MAJOR CONCLUSION OF THE WORK IS THAT EVEN LOW-QUALITY SPEECH IS ACCEPTABLE TO CASUAL USERS, IF THE SERVICE IS SUFFICIENTLY INTERESTING AND USEFUL TO THEM. (A)

COMMENTS:

THIS PAPER MAKES SEVERAL GOOD POINTS ABOUT VOICE ANSWER-BACK AS AN OUTPUT TECHNIQUE. USING THE METHOD DESCRIBED, VERY LITTLE INFORMATION NEED BE STORED IN ORDER TO REPRESENT ACOUSTIC SIGNALS AND APPLICATION PROGRAMMERS CAN EASILY CHANGE THE FORM OR NATURE OF THE OUTPUT. THESE POINTS OFFER VERY USEFUL ADVANTAGES OVER OTHER PROPOSED TECHNIQUES FOR VOICE ANSWER-BACK. IT IS INTERESTING TO NOTE THAT ALTHOUGH SPECH QUALITY IS FAIRLY LOW, USER ACCEPTANCE IS HIGH. USER ACCEPTANCE IS APPARENTLY RELATED TO THE FACT THAT THE SYSTEM IS EASY TO USE, USERS PERCEIVE IT AS PROVIDING A USEFUL SERVICE, AND THE NATURE OF THE DIALOGUE IS CONSISTENT WITH GENERALLY ACCEPTED GUIDELINES. THE AUTHORS ALSO PROVIDE A FAIR CRITIQUE OF THE DISADVANTAGES OF THIS SYSTEM AND OFFER RECOMMENDATIONS FOR IMPROVEMENTS. THIS PAPER INDICATES THAT VOICE ANSWER-BACK IS PRACTICAL AND MAY BE VALUABLE IN A VARIETY OF MAN-COMPUTER DIALOGUE SITUATIONS.

557 CONSOLE DESIGN
WOOD, J. THE APPLICATION OF ERGONOMICS IN THE DESIGN OF A COMPUTER CONSOLE FOR
EMERGENCY SERVICES: A CASE STUDY. IN PROCEEDINGS, 6TH CONGRESS OF THE
INTERNATIONAL ERGONOMICS ASSOCIATION, SANTA MONICA, CALIFORNIA: HUMAN FACTORS

SOCIETY, 1976, 255-259. DESCRIPTION:

A DETAILED CASE-STUDY IS PRESENTED OF THE SYSTEMATIC APPLICATION OF ERGONOMICS TO THE DESIGN OF COMPUTERIZED WORKSTATIONS. THESE WORKSTATIONS, FOR HANDLING EMERGENCY CALLS, INCORPORATE RADIO AND TELEPHONE EQUIPMENT AS WELL AS COMPUTER DISPLAYS AND KEYBOARDS. THE USE OF SYSTEMS ANALYSIS TECHNIQUES, THE PREPARATION OF PERFORMANCE SPECIFICATIONS, THE DESIGN AND USE OF ERGONOMIC RIGS AND THE RUNNING OF TRIALS FOR EVALUATION OF PROTOTYPES ARE DISCUSSED. (A)

5P, 3R. COMMENTS:

THIS PAPER CONTAINS A BRIEF DISCUSSION OF THE STAGES INVOLVED IN THE APPLICATION OF HUMAN FACTORS METHODS TO A PARTICULAR SYSTEM DESIGN.
ALTHOUGH THESE STAGES MAY BE DESIRABLE AND NECESSARY, THE AUTHOR DOES NOT ATTEMPT TO JUSTIFY THEIR INCLUSION OR ARGUE FOR GENERALITY IN OTHER DESIGN APPLICATIONS. IN THE PARTICULAR APPLICATION DISCUSSED, EQUIPMENT WAS FULLY SPECIFIED AND THE EMPHASIS IS ON EQUIPMENT LAYOUT. THE AUTHOR ALSO INDICATES THE PROBLEMS THAT ARISE DUE TO LACK OF STANDARDIZATION AMONG DIFFERENT MANUFACTURERS WITH RESPECT TO SIZE, ACTIVATION, COLOR CODING AND LAYOUT OF CONTROLS. ALTHOUGH THIS IS A NON-TECHNICAL PAPER, THE SUGGESTIONS THAT ARE MADE WOULD BE RELATIVELY INEXPENSIVE TO IMPLEMENT AND MAY BE USEFUL IN SITUATIONS WHERE CONSOLE DESIGN MUST PROCEED WITHOUT INPUT FROM TRAINED HUMAN FACTORS PERSONNEL. THIS PAPER WOULD BE USEFUL AS AN INTRODUCTION TO HUMAN FACTORS TECHNIQUES IN CONSOLE DESIGN, BUT IT WOULD NOT BE RELEVANT TO ANYONE WISHING A MORE TECHNICAL DISCUSSION.

SS8 GENERAL PROPERTIES FOR INTERACTIVE SYSTEMS
WOOD, R.C. INFERENCES FROM THE UCSB ON-LINE SYSTEM FOR MAN-SYSTEM INTERFACE
DESIGN. IN PROCEEDINGS OF THE 1972 INTERNATIONAL CONFERENCE ON CYBERNETICS
AND SOCIETY. NEW YORK: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS,
INC., 1972, 120-125.
DESCRIPTION:

EXPERIENCE WITH THE UNIVERSITY OF CALIFORNIA, SANTA BARBARA ON-LINE SYSTEM (OLS) IS EXAMINED TO DETERMINE HOW THE SYSTEM DESIGN HAS AFFECTED THE NATURE OF THE MAN-SYSTEM INTERFACE. IT IS OBSERVED THAT THE OLS DATA ORGANIZATION HAS MADE THE SYSTEM HIGHLY INTERACTIVE AND EASY TO LEARN AND USE. THE USE OF THE SYSTEM IN A TEACHING ENVIRONMENT IS DISCUSSED, AND THE ENHANCEMENT OF THE LEARNING PROCESS EXPLORED. FINALLY, SPECIFIC DESIGN GOALS AND PROBLEMS ARE PRESENTED IN LIGHT OF THIS EXPERIENCE. (A) 6P, 12R.

COMMENTS:

THIS IS A VERY BROAD, GENERAL DISCUSSION OF SOME MAN-COMPUTER INTERFACE DESIGN FACTORS. IT ILLUSTRATES SOME SPECIFIC FEATURES FOUND IN THE UCSB MATHEMATICAL SYSTEM, INCLUDING A DUAL KEYBOARD, HIGH-LEVEL ALGEBRAIC OPERATORS AND SEVERAL DATA STRUCTURE TYPES. THE AUTHOR'S MOST IMPORTANT THESIS SEEMS TO BE THAT THE USE OF HIGH-LEVEL OPERATORS AND DATA STRUCTURES ALLOWS A HIGH MESSAGE CONTENT FOR EACH USER ACTION, WHICH IN TURN INCREASES THE INFORMATION TRANSMISSION RATE AND REDUCES THE DATA TRANSFORMATION BURDEN ON THE OPERATOR. THIS IS UNDOUBTEDLY CORRECT. THE AUTHOR ALSO DISCUSSES A LAYERED APPROACH TO USER TRAINING, USING VIDEOTAPE. HE REPORTS GREAT SUCCESS, AND A FEW PITFALLS, WITH THE USE OF THE SYSTEM TO SUPPLEMENT CLASSROOM INSTRUCTION BY ALLOWING HANDS-ON MANIPULATION OF MATHEMATICAL MODELS. SOME RATHER GENERAL RECOMMENDATIONS ARE MADE CONCERNING ERROR PREVENTION AND RECOVERY AND SYSTEM RESPONSE TIME (BOTH OF WHICH EMPHASIZE THE PROVISION OF FEEDBACK TO THE USER). THE "MY EXPERIENCES" PAPER CONTAINS LITTLE THAT IS NEW TO THOSE ACQUAINTED WITH STANDARD HUMAN FACTORS GUIDELINES AND PRACTICES, BUT HAS, AT LEAST, THE ADVANTAGE OF AN EXAMPLE IN TERMS OF WHICH THOSE PRACTICES ARE DISCUSSED.

559 MAN-COMPUTER PROBLEM SOLVING
WYLIE, C.D., DICK, R.A., & MACKIE, R.R. TOWARD A METHODOLOGY FOR MAN-MACHINE
FUNCTION ALLOCATION IN THE AUTOMATION OF SURVEILLANCE SYSTEMS. VOLUME I:
SUMMARY (TECHNICAL REPORT 1722-F, VOLUME 1). GOLETA, CALIFORNIA: HUMAN FACTORS
RESEARCH, INC., JULY 1975. (NTIS NO. AD A017103)

A STUDY WAS CONDUCTED TO DETERMINE SOME OF THE PERFORMANCE IMPLICATIONS OF VARIOUS DEGREES OF AUTOMATION IN SURVEILLANCE SYSTEMS. THE OBJECTIVE WAS TO AID SYSTEM DESIGNERS OF FUTURE SURVEILLANCE SYSTEMS IN MAKING TRADE-OFF DECISIONS. A GENERAL FUNCTIONAL TAXONOMY OF SURVEILLANCE SYSTEMS WAS DEVELOPED AND EACH FUNCTION WAS CONSIDERED IN TERMS OF THE NECESSITY OF OPERATOR INVOLVEMENT VERSUS THE LIKELY SUCCESS OF FULL AUTOMATION, BASED ON THE PRESENT STATE-OF-THE-ART AND KNOWLEDGE OF RECENT SUCCESSES AND FAILURES IN AUTOMATING SURVEILLANCE SYSTEM FUNCTIONS.

A MODEL OF HUMAN INFORMATION PROCESSING IN SURVEILLANCE SYSTEMS WAS ALSO DEVELOPED AND VARIOUS STRENGTHS AND WEAKNESSES OF SURVEILLANCE SYSTEM OPERATORS WERE DISCUSSED IN RELATION TO THE ELEMENTS OF THE MODEL. OBSERVATIONS WERE MADE ON THE EXTENSIVE INDIVIDUAL DIFFERENCES IN PERFORMANCE AMONG SURVEILLANCE SYSTEM OPERATORS AND SOME OF THE REASONS FOR THESE DIFFERENCES. CONSIDERATION WAS GIVEN TO SPECIAL PROBLEMS IN THE DESIGN OF SYSTEM TESTS AND EVALUATIONS, GIVEN THESE EXTENSIVE OPERATOR PERFORMANCE DIFFERENCES, AND SEVERAL DITHER VARIABLES TYPICALLY ASSOCIATED WITH SURVEILLANCE SYSTEM OPERATIONS. THE PERFORMANCE OF SUPERIOR OPERATORS AS A DESIGN MODEL FOR AUTOMATION OF SURVEILLANCE SYSTEMS WAS DISCUSSED. (A) 85P., 51R.

COMMENTS:

DESCRIPTION:

THE FUNCTIONAL TAXONOMY PRESENTED IN THIS PAPER, THAT INVOLVES 55 SUBTASKS IN TWELVE MAJOR CATEGORIES, APPEARS TO PROVIDE A GOOD STARTING POINT FOR CONSIDERING MAN-COMPUTER TASK ALLOCATION DECISIONS IN SURVEILLANCE SYSTEMS. SUGGESTIONS FOR TASK ALLOCATION ARE MADE ON THE BASIS OF AN INFORMATION PROCESSING MODEL OF MAN. ALTHOUGH PRESENTED AT A LOW LEVEL, THIS MODEL IS GENERALLY CONSISTENT WITH CURRENT PSYCHOLOGICAL THEORIES. ALTHOUGH THE IDEAS EXPRESSED IN THIS PAPER ARE NOT EMPIRICALLY TESTED, THE COMBINATION OF A FUNCTIONAL TAXONOMY AND AN INFORMATION PROCESSING MODEL SHOULD BE QUITE EFFECTIVE. THE DISCUSSIONS OF INDIVIDUAL DIFFERENCES AND PERFORMANCE MEASUREMENT, THOUGH BRIEF, CONTAIN SEVERAL INTERESTING IDEAS. THIS PAPER WOULD BE RELEVANT TO THOSE CONCERNED WITH THE DESIGN OF SURVEILLANCE SYSTEMS AND WOULD ALSO BE OF GENERAL INTEREST TO ANYONE CONCERNED WITH MAN-COMPUTER TASK ALLOCATION.

560 BIOTECHNOLOGY OF KEYPUNCHING

YLLO, A. THE BIO-TECHNOLOGY OF CARD PUNCHING. ERGONOMICS, 1962, 5, 75-79. DESCRIPTION:

THIS PAPER DESCRIBES A PRACTICAL APPLICATION OF BID-TECHNOLOGY IN THE FORM OF AN INVESTIGATION AND SUBSEQUENT IMPROVEMENTS IN WORKING CONDITIONS FOR KEYPUNCH OPERATORS. THE ACTIVITIES REQUIRED IN KEYPUNCHING WERE ANALYZED WITH RESPECT TO HUMAN PHYSIOLOGY AND SUGGESTIONS ARE MADE FOR RE-DESIGNING EQUIPMENT TO BE MORE COMPATIBLE WITH PHYSIOLOGICAL FACTORS. (A & MEA) 5P, OR.

COMMENTS:

THIS IS A FAIRLY GOOD EXAMPLE OF A "CLASSICAL" APPLICATION OF HUMAN FACTORS TO EQUIPMENT DESIGN. THE STUDY INVOLVED MEASURING PHYSIOLOGICAL ACTIVITIES OF KEYPUNCH OPERATORS, DETECTING MUSCLE STRESS, AND REDESIGNING EQUIPMENT TO REDUCE STRESS. THIS STUDY IS CLEARLY PRESENTED AND, ALTHOUGH THE PRESENTED GUIDELINES MAY NOT BE PARTICULARLY USEFUL NOW, IT DOES ILLUSTRATE IMPORTANT CONSIDERATIONS IN EQUIPMENT DESIGN.

561 MULTIPLE-CRITERION DECISION-MAKING AIDS
YNTEMA, D.B., & KLEM, L. TELLING A COMPUTER HOW TO EVALUATE MULTIDIMENSIONAL
SITUATIONS. IEEE TRANSACTIONS ON HUMAN FACTORS IN ELECTRONICS, 1965, HFE-6,
3-13.

DESCRIPTION:

IF A PERSON COULD TELL A COMPUTER EXACTLY HOW HE WOULD EVALUATE EVERY
ALTERNATIVE THAT MIGHT ARISE, THE MACHINE COULD DECIDE BETWEEN ANY TWO
ALTERNATIVES AS THE PERSON HIMSELF WOULD. A FAIRLY REALISTIC EXPERIMENT
WAS DONE TO TEST THE FEASIBILITY OF "INTERPOLATION BETWEEN CORNERS" AS A
PSYCHOPHYSICAL METHOD FOR TELLING A MACHINE HOW TO COMPUTE THE WORTHS OF
MULTIDIMENSIONAL ALTERNATIVES. THE RESULTS WERE SATISFACTORY.

A STATISTIC CALLED FRACTIONAL DISAGREEMENT IS PROPOSED AS THE PROPER MEASURE OF THE MACHINE'S SUCCESS IN MIMICKING THE MAN'S DECISIONS. THE CONCEPT OF CONFLICT BETWEEN THE DIMENSIONS OF TWO ALTERNATIVES IS EXPLAINED. THE SIZE OF THE CONFLICT AND THE SIZE OF THE DIFFERENCE BETWEEN THE WORTHS THAT THE MACHINE ASCRIBED TO THE ALTERNATIVES WERE FOUND TO HELP TO PREDICT THE CORRECTNESS OF THE MACHINE'S DECISION. CONFLICT AND DIFFERENCE IN COMPUTED WORTH SHOULD, THEREFORE, BE USEFUL IN DEFINING REGIONS WHERE THE MACHINE SHOULD GIVE THE DECISION BACK TO THE MAN AND TELL HIM TO MAKE THE CHOICE. (A)

COMMENTS:

IN AN EARLIER PAPER (D.B. YNTEMA AND W.S. TORGERSON, 1961) IT WAS ASSUMED THAT IN MOST CASES WHERE DECISIONS ARE BASED ON MULTIPLE CRITERIA THE DECISION MAKER CONSIDERS ONLY THE MAIN EFFECTS OF THOSE CRITERIA AND IGNORES THE INTERACTIONS. THE VALIDITY OF THIS ASSUMPTION IS QUESTIONABLE AND THE PRESENT PAPER EXTENDS THE PRESUMED DECISION MAKING STRATEGY TO ALLOW FOR INTERACTIONS. THE ULTIMATE GOAL OF THE RESEARCH DESCRIBED IS TO DEVELOP A COMPUTER AID THAT CAN ACCURATELY PREDICT THE HUMAN'S DECISIONS. THIS PAPER ADDRESSES THE PRELIMINARY GOALS OF CAPTURING THE HUMAN DECISION MAKER'S STRATEGY SO THAT IT CAN BE SPECIFIED IN A COMPUTER-ACCEPTABLE FORM AND OF DEVELOPING STATISTICS TO EVALUATE THE PERFORMANCE OF A COMPUTERIZED DECISION—MAKING SYSTEM. AN EXPERIMENT IS BRIEFLY REPORTED AND THE AUTHORS CONCLUDE, CORRECTLY, THAT THEY HAVE MADE SOME PROGRESS TOWARD ACHIEVING THESE TWO GOALS, BUT ADDITIONAL RESEARCH IS REQUIRED. MORE RECENT DEVELOPMENTS THAT ATTEMPT TO CAPTURE A HUMAN DECISION MAKER'S STRATEGY THROUGH MAN-COMPUTER INTERACTION APPEAR MORE PROMISING. THE QUESTION OF DEVELOPING APPROPRIATE STATISTICS APPEARS TO BE A PROBLEM IN MOST AREAS OF MAN-COMPUTER INTERACTION.

562 MULTIPLE-CRITERION DECISION AIDS
YNTEMA, D.B., & TORGERSON, W.S.. MAN-COMPUTER COOPERATION IN DECISIONS
REQUIRING COMMON SENSE. IRE TRANSACTIONS ON HUMAN FACTORS IN ELECTRONICS,
1961, HFE-2, 20-26.
DESCRIPTION:

MEN AND COMPUTERS COULD COOPERATE MORE EFFICIENTLY IN REAL-TIME SYSTEMS -AND PERHAPS IN LONG-RANGE PLANNING TOO -- IF A MAN COULD TELL THE COMPUTERS
HOW HE WANTED DECISIONS MADE, AND THEN LET THE MACHINE MAKE THE DECISIONS
FOR HIM. IN THE NEXT FEW YEARS THERE WILL PROBABLY BE COMSIDERABLE PRESSURE
ON SYSTEM DESIGNERS TO ADOPT SUCH ARRANGEMENTS. THE PROBLEM OF ENABLING
A MAN TO CONVEY HIS DECISION RULES TO A MACHINE WILL IN MANY CASES
PROVE LESS FORMIDABLE THAN IT HIGHT FIRST APPEAR. THREE METHODS ARE
DISCUSSED. AS EXPERIENCE WITH MAN-MACHINE COOPERATION OF THIS TYPE
ACCUMULATES, PROBLEMS FOR RESEARCH WILL BE GENERATED. AN ATTEMPT IS
MADE TO FORESEE WHAT SOME OF THEM WILL BE. (A)
7P, 7R.

### COMMENTS:

IN MANY SITUATIONS, DECISIONS ARE BASED ON SEVERAL CRITERIA. THIS PAPER MAKES THE ASSUMPTION THAT, IN MOST CASES, A DECISION MAKER CONSIDERS ONLY THE MAIN EFFECTS OF THESE CRITERIA AND IGNORES THE INTERACTIONS. WHILE THIS SIMPLIFIES THE TASK OF SPECIFYING DESIGN RULES, THE VALIDITY OF THIS ASSUMPTION HAS NOT BEEN CONCLUSIVELY DEMONSTRATED. IT HAS BEEN DEMONSTRATED ELSEWHERE, HOWEVER, THAT IT IS MORE DIFFICULT TO LEARN CONCEPTS INVOLVING INTERACTIONS THAN CONCEPTS INVOLVING ONLY MAIN EFFECTS. ALTHOUGH A SIMPLE LINEAR MODEL MAY DESCRIBE OBSERVABLE BEHAVIOR, IT MAY NOT ADEQUATELY DESCRIBE THE WAY A DECISION MAKER VIEWS THE PROBLEM. IN ORDER TO HAVE EFFECTIVE MAN-COMPUTER INTERACTION IT IS NECESSARY THAT THE COMPUTER ACCURATELY MODEL THE USER'S DECISION MAKING PROCESSES AND NOT MERELY DESCRIBE HIS OVERT BEHAVIOR. RATHER THAN USING A COMPUTER TO ENCODE AND EXECUTE LINEAR, ADDITIVE DECISIONS RULES, IT MAY PROVE PRODUCTIVE TO USE A COMPUTER TO HELP THE DECISION-MAKER DEAL MORE EFFECTIVELY WITH INTERACTIONS.

CONSOLE AS EXTENDED MEMORY AID
ZEIGLER, B.P., & SHERIDAN, T.B. HUMAN USE OF SHORT-TERM MEMORY IN PROCESSING
INFORMATION ON A CONSOLE (TECHNICAL REPORT ESD-TDR-64-620). L.G. HANSCOM
FIELD, BEDFORD, MASSACHUSETTS: AIR FORCE SYSTEMS COMMAND, ELECTRONIC SYSTEMS
DIVISION, SEPTEMBER 1964. (NTIS NO. AD 609749)
DESCRIPTION:

THIS REPORT ASSUMES THAT AN OPERATOR'S CONSOLE CONSTITUTES A THIRD FORM OF MEMORY IN ADDITION TO THAT INTEGRAL TO THE HUMAN AND THAT INTEGRAL TO THE MACHINE WHICH IS NOT DIRECTLY ACCESSIBLE TO THE HUMAN. QUESTIONS ARE RAISED CONCERNING THE CHARACTERISTIC MODES OF HUMAN STORAGE AND RETRIEVAL OF INFORMATION FROM INTERNAL MEMORY WHEN SUCH EXTERNAL MEMORY IS ACCESSIBLE.

THE REPORT ALSO INTRODUCES THE CONCEPT OF ASSOCIATIVE MEMORY NETS FORMED BY CUE-RELATED IMAGES OF EXTERNAL EVENTS. INFORMATION LOSS OCCURS WHEN CUES, ORIGINALLY CAPABLE OF PROVIDING ACCESS TO IMAGES, BECOME INSUFFICIENT TO DIRECT RETRIEVAL. IN SURSEQUENT MEMORY ORDOTH

TO DIRECT RETRIEVAL, IN SUBSEQUENT MEMORY GROWTH.

A LIST PROCESSING EXPERIMENT IS DESCRIBED. THE PROCESSING INVOLVES
ADDING OR REMOVING SEQUENTIALLY PRESENTED "ITEMS" (ALPHANUMERIC CHARACTERS)
FROM A LIST OF PREVIOUSLY PROCESSED ITEMS. TWO CONDITIONS ARE ESTABLISHED
IN WHICH ITEMS ARE (1) PRESENTED DIRECTLY, OR (2) COMPUTED FROM PRESENTED
DATA.

STORAGE STRUCTURES CHARACTERIZING INTERNAL HUMAN MEMORY AND EXTERNAL CONSOLE MEMORY IN THIS TASK ARE POSTULATED. A RETRIEVAL MODEL IMPLIED BY THESE STRUCTURES IS CONSTRUCTED TO ACCOUNT FOR THE EFFECTS OF COMPUTATION AND LEARNING UPON THE FEATURES OF THE EXPERIMENTALLY OBTAINED CURVES. INSUFFICIENT RETRIEVAL OF REQUIRED INFORMATION FROM INTERNAL MEMORY IS ASSUMED TO NECESSITATE EXTERNAL MEMORY SEARCH. THE EFFECT OF COMPUTATION IS TO INCREASE THE PROBABILITY OF INSUFFICIENT RETRIEVAL AND HENCE, THE FREQUENCY OF EXTERNAL SEARCH. LEARNING DECREASES THIS PROBABILITY. THE EFFECTS OF INDUCING ALTERNATE FORMS OF INTERNAL STORAGE ARE STUDIED AND FOUND GENERALLY TO RESULT IN INCREASED STORAGE AND RETRIEVAL TIMES. IMPLICATIONS FOR CONSOLE DESIGN ARE DISCUSSED. (A) 47P. 13R.

COMMENTS:

THIS IS A WELL-DESIGNED SERIES OF EXPERIMENTS TO INVESTIGATE THE ROLE OF SHORT-TERM MEMORY IN PROCESSING DISPLAYED INFORMATION. A MAJOR CRITICISM, HOWEVER, IS THE USE OF ONLY TWO SUBJECTS. LARGE PERFORMANCE VARIABILITY IS TYPICALLY OBSERVED IN INFORMATION PROCESSING TASKS AND IS ALSO APPARENT IN THESE EXPERIMENTS. IN ADDITION, THERE IS NO ATTEMPT AT DATA SUMMARIZATION OR STATISTICAL ANALYSIS.

564 CONSOLE AS EXTENDED MEMORY AID

ZEIGLER, B.P., & SHERIDAN, T.B. HUMAN USE OF SHORT-TERM MEMORY IN PROCESSING INFORMATION ON A CONSOLE. IEEE TRANSACTIONS ON HUMAN FACTORS IN ELECTRONICS, 1965, HFE-6, 74-83.

DESCRIPTION:

THE ROLE OF A HUMAN OPERATOR PERFORMING AN INFORMATION-PROCESSING TASK AT A CONSOLE IS STUDIED. SPECIFICALLY EXPLORED ARE (1) THE ROLE OF THE CONSOLE AS A FORM OF MEMORY AND (2) THE WAYS IN WHICH THIS MEMORY INTERACTS WITH THE HUMAN MEMORY DURING A SIMPLE LIST-PROCESSING TASK.

TIMES FOR VARIOUS PHASES OF THE TASK ARE MEASURED UNDER FOUR EXPERIMENTAL CONDITIONS WHICH SYSTEMATICALLY CONSTRAIN THE USE OF HUMAN OR CONSOLE MEMORY. THREE CONCEPTUAL MODELS ARE PROPOSED: TWO CHARACTERIZE THE STRUCTURE OF, AND RETRIEVAL FROM, HUMAN AND/OR CONSOLE MEMORY WHEN THESE ARE FREELY USED TOGETHER; THE THIRD CHARACTERIZES THE USE OF HUMAN MEMORY WHEN VISUAL SEARCH OF THE CONSOLE MEMORY IS VERY LIMITED. (A) 10P, 13R.

COMMENTS:

THIS IS A PUBLICATION VERSION OF A PAPER PRESENTED BY B.P. ZEIGLER AND T.B. SHERIDAN (1964). THE PRESENT PAPER INCORPORATES PRIMARILY STYLISTIC CHANGES AND IS IDENTICAL IN ALL SUBSTANTIVE ASPECTS TO THE ORIGINAL PAPER.

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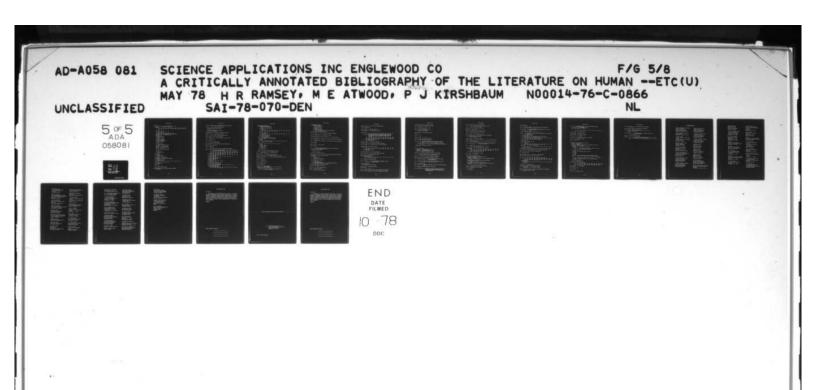
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